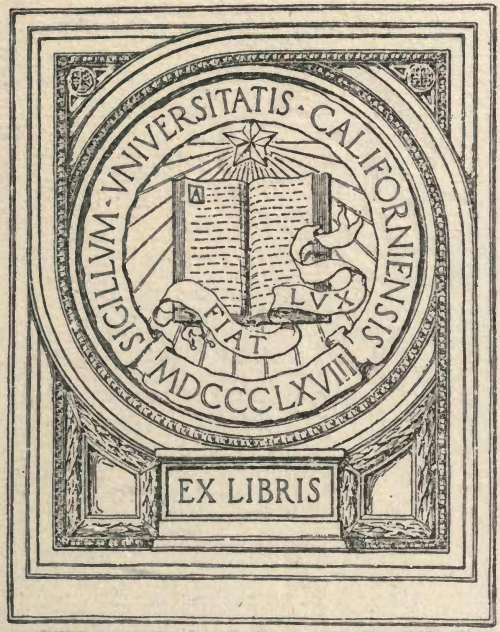

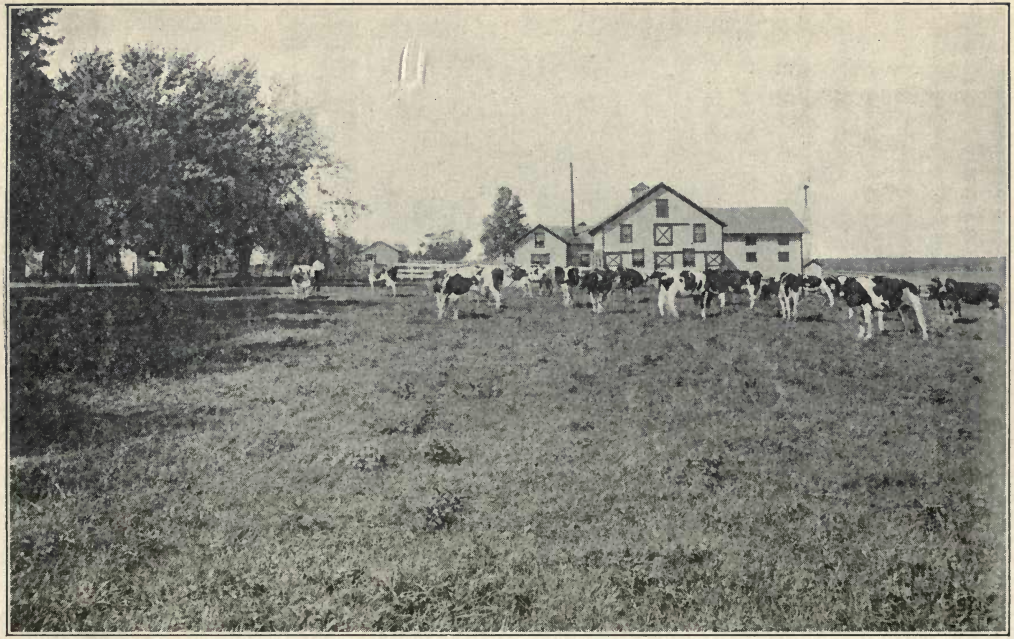

THE BUSINESS OF DAIRYING

HOW TO CONDUCT DAIRY FARMING FOR THE LARGEST PROFIT

By

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To My Wife

WHOSE UNTIRING EFFORTS AND VALUABLE ASSISTANCE
HAVE MADE POSSIBLE THE PRESENTATION
OF THIS BOOK

PREFACE

THIS little book has been prepared for the use of dairy students, producers and handlers of milk, and all who make dairying a business. Its purpose is to present in clear and concise form various business methods and systems which will help the dairyman to reap greater profits.

The main effort of every business man is to secure the largest possible return for every dollar expended, and it is hard to convince dairy farmers that in their branch of business, as in any other, an accurate account of expenditures and receipts must be kept, in order to determine where profits are made or losses occur. Simple methods of keeping these records, accounts, etc., within the scope of the average dairyman, have been presented and, in as many instances as possible, the forms and methods themselves have been used instead of descriptions of them.

No attempt has been made to go into details of growing crops, as this is not the field of the book. The work will be found helpful to dairy students, and may be used as a text book or reference in dairy schools.

The book has been written largely from the author's experience. He desires to acknowledge special obligations to Prof. Ivan C. Weld, U. S. Department of Agriculture, and Prof. William A.

Stocking of Cornell University, for reading the proof and for valuable criticisms, and to Prof. Edward H. Webster, Chief of Dairy Division, U. S. Department of Agriculture, and Dr. E. B. Voorhees, Director of New Jersey Experiment Stations, through whose courtesy the writer obtained a number of valuable illustrations.

Washington, D. C., October 1, 1908.

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In these days of sharp competition, it is necessary for the dairy farmer to make a close study of his business if he is to succeed. Like the manufacturer, he must know exactly what his products cost him and determine the sources of his profits and losses. In fact, he should make a business proposition of the whole farm. We can point to one here and there who has followed this plan with wonderful success, but the condition of the dairy industry, as seen on the average farm, points to the need of better methods and a more definite knowledge of the business. In no department connected with the farm is there more need for absolute data than in the dairy.

Investigations of the financial condition of progressive and unprogressive dairymen indicate that there is no business which shows a greater range of profit than that of dairy farming. There is need of more careful business methods in the selection and breeding of dairy cows; keeping records of the yield

of milk; the cost of rations, and the fertility elements added to and taken from the soil. Too much money is expended by the average dairy farmer for commercial feeding stuffs, and a large percentage of the foods for our dairy herds should be grown on the farm. Many comparatively small farms would be capable of carrying a large herd if a more intensive system of growing crops were practiced.

Many dairy farmers fail to reap the profits they should because of an inferior product, due to insanitary conditions. A first-class product is always in demand at profitable prices. The dairy farmer should make an effort to establish a reputation for his dairy and his product: first, by having a good product, and second, by advertising or in some way calling the attention of the consumer to it. If his product is market milk, this object may be accomplished by having a reputable veterinarian examine his cows, a bacteriologist and chemist his product, and some dairy inspector certify to the sanitary condition of his stable, dairy house, etc. If his product is butter, let him make it the best; have a butter judge examine and criticize it, and then sell the butter under his name or brand it so it can always be identified in the market.

The dairy farmer to-day has abundant opportunity to practice the most up-to-date business methods. With the telephone in his house connecting him with all the markets in the nearest city; the trolley passing his door; the rural delivery system for collecting and distributing his mail; improved roads enabling him to haul heavy loads with the

least power; and, most important of all, an abundance of literature on all subjects pertaining to his business, that he can have almost for the asking, certainly the dairy farmer has every opportunity to carry on a profitable business. What he needs is the best knowledge, then the intelligence to apply it.

One of the reasons why dairying is not found profitable by many is that dairying is made secondary to other farm work and is not handled in a business way. With a small number of cows and a small product to dispose of, the small dairyman does not and cannot afford to equip his place with the necessary apparatus for producing a good product. A dairyman under these circumstances should do one of two things, either enlarge his dairy work and conduct it as a business, or give it up altogether and follow some other line of work. With more strict laws regarding the methods of producing and handling milk, and with the increased use of the milking machine, the tendency in the future will be to increase the number of large dairies and reduce the number of small ones.

PART I—THE SOIL

CHAPTER I

A DEBIT AND CREDIT ACCOUNT WITH THE SOIL

THE first consideration in dairy farming is naturally the soil. This is an important part of the dairyman's capital and perhaps shows the effects of good business methods more strikingly than any other branch of his work. It is possible to keep a debit and credit account with the soil and thus show the condition of each acre of the farm from the standpoint of fertility and the amount of the crops removed from time to time.

We will take one acre of land for an illustration and this will be considered the same as a bank; that is, our capital stock will represent the constituents in the soil, our deposits the fertility elements applied to the soil, our expenditures the fertility elements removed from the soil in the crops taken off.

Capital, the soil.—We will consider first our capital. What does our bank contain? We may make a chemical analysis of the soil, but this will not give us an accurate value of it, since a part of the plant food is not available, and some of the power of the plant to secure that which is available depends upon

many conditions, such as the proper preparation of the land, the kind of crops raised, the relative amounts of the various required constituents and the amount of moisture present. A chemical analysis, however, will give us some idea of the composition and value of our soil. The analyses of soils made by reliable chemists show that even the poorer soils have an abundance of plant food for several crops, while the richer soils in some cases have sufficient for many years. Since the soil and subsoil contain such stores of fertility and since such deep-rooted plants as clovers and alfalfa bring to the surface abundant quantities of nitrogen with some mineral matter, and since many fields receive applications of farm manure from time to time, there must be some cause tending to restrict production. The principal causes of low yields of farm crops are found in imperfect preparation of the soil and poor tillage. As a result there is a lack of available plant food and insufficient moisture sometimes during growth. We need to better appreciate and utilize nature's storehouse.

Deposits.—Last year's plant food will not do for this year's any more than last year's plowing. Growing crops must have nitrogen, phosphoric acid and potash as food, which eventually becomes a part of the natural plant. This fixed in mind, the intelligent handling of the fertilizing problem becomes a simple matter. We will regard the soil, then, as a bank in which the forms of plant food are deposited as incomes or fertilizers and drawn out in the form of salable crops. On the average soil, farm-produced

manures are used to the best advantage when supplemented with commercial fertilizers containing available phosphoric acid and potash. Good authorities recommend that for every ton of stable manure applied, 50 to 100 pounds of acid phosphate and 25 to 50 pounds of high-grade muriate or sulphate of potash be used.

Home mixing of fertilizers.—The farmer should mix his own fertilizers—that is, he should buy the separate ingredients and put them together according to the formulas desired. In doing this he will learn what the different forms of plant food are, what they are valuable for and from what source they can be obtained. He will become to some extent an investigator and will of necessity take a deeper interest in his work. In purchasing the separate ingredients the object sought should be to secure as much nitrogen, phosphoric acid and potash in available form as possible for $1, instead of as many pounds of fertilizer as possible regardless of the amount of plant food contained in them. The quality and cost of home mixtures analyzed by the experiment stations indicate very clearly the advantage of this method of purchase. When the cost of plant food purchased in this way is compared with the average cost of that in the regular brands, there is frequently shown a saving of 30 per cent.

Expenditures.—The relation of deposits or fertility ingredients to expenditures can perhaps best be illustrated by a balance sheet from an acre of land at the New Jersey Agricultural College Farm, where an exact record of 76 acres was kept by the

BALANCE SHEET FOR ONE ACRE OF LAND

PLOT 16

Record for the Years 1897, 1898, 1899 *Dr.*

Date	Manures, Fertilizers, Labor, and Seed	Cost	Amount Applied		
			Nitrogen	Phosphoric Acid	Potash
	1897.		Lbs.	Lbs.	Lbs.
	To Fertilizer—				
April	75 lbs. ground bone	$0 93	2.97	18.00	.....
"	75 lbs. muriate of potash	1 46	.....	.....	41.37
"	75 lbs. acid phosphate	38	.....	13.11	.....
	To Labor and Seed—				
	Harrowing, 4 hours	1 20			
	Rolling, 1 hour	30			
	Carting weeds, 1 hour	20			
	Man 1 hour	20			
	12 lbs. crimson clover	72			
	Total	$5 39	2.97	31.11	41.37
	1898.				
	To Fertilizer—				
June 1	6.7 tons manure	$10 05	42.88	44.22	68.34
	To Labor and Seed—				
" 10	Plowing, 9 hours	$2 70			
" 11	Harvesting, rolling, planting, 9 hrs.	2 70			
	12 quarts corn	25			
" 22	Cultivating, 1½ hours	45			
" 22	Sowing crimson clover, 1 hour	20			
	12 lbs. crimson clover seed	72			
	Total	$17 07	42.88	44.22	68.34
	1899.				
	To Fertilizer—				
June 1	6.1 tons manure	$9 15	39.04	40.26	62.22
" 21	50 lbs. acid phosphate	23	.....	10.17	.....
" 21	25 lbs. ground bone	32	.86	6.14	.....
" 21	25 lbs. muriate of potash	50	.....	.....	13.79
	To Labor, Seed, etc.—				
" 21	Plowing, 5 hours $1 50				
	Harvesting, rolling, etc., 3 hrs. 90				
		2.40			
	Planting corn, 1 hour $0.30				
	Sowing fert., 1 hour 10				
		40			
	10 qts. Southern white corn	25			
July 4-27	Cultivating, 6 hours $1 80				
	12 lbs. crimson clover 72				
		2 52			
Oct. 12	Plowing, harvesting, rolling, 10 hrs.	3 00			
	2 bu. rye, at 55 cents $1 10				
	Drilling, 1 hour 30				
		1 40			
	Total	$20 17	39.90	56.57	76.01

BALANCE SHEET FOR ONE ACRE OF LAND

PLOT 16

Record for the Years 1897, 1898, 1899, 1900, 1901 *Cr.*

Date	Crops Grown	Yield	Value	Amount Removed		
				Nitrogen	Phosphoric Acid	Potash
	1897.	Tons	$	Lbs.	Lbs.	Lbs.
July	By corn fodder, at $3.00 per ton...	10.74	32.22	58.00	32.22	70.88
	Total.....	10.74	32 22	58.00	32.22	70.88
	1898.					
June	By crimson clover, at $3.50.....	11.00	38.50	110.00	28.60	85.80
Aug.	By 8.00 tons corn fodder, at $3.00..	8.00	24.00	43.20	24.00	52.80
	Total.....	19.00	62.50	153.20	52.60	138.60
	1899.					
May	By crimson clover, at $3.50.....	5.00	17.50	50.00	13.00	39.00
Sept.	By 16.20 tons corn fodder, at $3.00.	16.20	48.60	87.48	48.60	109.92
	Total.....	21.20	66.10	137.48	61.60	148.92

BALANCE SHEET FOR ONE ACRE OF LAND

(Continued)

PLOT 16

Record for the Years 1900, 1901 — *Dr.*

Date	Manures, Fertilizers, Labor, and Seed	Cost	Amount Applied		
			Nitrogen	Phosphoric Acid	Potash
	1900		Lbs.	Lbs.	Lbs.
	To Fertilizer—				
May to Sept.	100 lbs. muriate of potash	$2 10	.....	.....	55.16
	100 lbs acid phosphate	60	.....	20.33	.....
	50 lbs. ground bone	63	1.72	12.27	.....
	50 lbs. nitrate of soda	1 03	7.93	.....	.....
	50 lbs. dried blood	85	7.16	.62	.....
	To Labor and Seed—				
May 25 to May 28	Plowing and fitting land, 9 hours	2 70			
	6 qts. Stowell's evergreen corn	40			
	Planting and sowing fert.	75			
June 19	Cultivating, 2 hours	60			
Sept. 22	Plowing, etc., 9 hours $2 70				
	Sowing fert. and grass seed.. 30				
		3 00			
	15 lbs. Mammouth red clover	1 80			
	Total	$14 46	16.81	33.22	55.16
	1901.				
	To Fertilizer—				
Feb.	7.9 tons manure	$11 85	50.56	52.14	80.58
April	100 lbs. muriate potash $2 00				
	50 lbs. bone 55				
		2 55	1.72	12.27	55.16
July	60 lbs. ground bone	33	2.06	14.72	63.43
	To Labor and Seed—				
April 2	Plowing, harvesting, drilling, 9 hrs.	2 70			
" 9	2 bu. oats $0 64				
	1½ bu. cowpeas 1 29				
		1 93			
July 9-10	Harvesting and rolling, 13 hrs.. $3 90				
	1.15 lbs. mur. potash 2 30				
		6 20			
	16 qts. kaffir corn $0 50				
	32 qts. cowpeas 2 50				
		3 00			
Sept. 11	Preparing ground, 11 hours.... $3 30				
	7 lbs. Essex rape 70	4 00			
	Total	$32 56	54.34	79.13	199.17
	Total, 5 years	$89 65	156 90	244.25	440.05

BALANCE SHEET FOR ONE ACRE OF LAND

PLOT 16

Record for Years 1900, 1901 *Cr.*

Date	Crops Grown	Yield	Value	Amount Removed		
				Nitrogen	Phosphoric Acid	Potash
	1900.	Tons	$	Lbs.	Lbs.	Lbs.
May	By rye fodder, at $3.00	4.10	12.30	33.62	21.30	54.94
Sept.	By sweet corn, at $3.00	5.90	17.70	31.86	17.70	38.94
	Total	10.00	30.00	65.48	39.00	93.88
	1901.					
July 1	By oats and peas, at $3.50	6.20	21.70	50.84	17.36	58.28
Sept. 1	By cowpeas and kaffir corn, at $3.50.	12.20	42.70	87.60	30.38	125.66
	Total	18.40	14.40	138.44	47.74	183.94
	Total, 5 years	79.34	255.22	552.60	233.16	636.22
	Balance	.....	165.57	—395.70	+31.26	—196.17

NOTE—The dairyman who wishes to calculate the fertility of his crops is referred to table in the appendix.

writer for seven years. The records include the manures and fertilizers applied to each crop and the fertility elements removed in the crops. A record is also shown of the cost of labor and seed, so that it is an easy matter not only to draw a balance with reference to the fertility elements, but to show the cost of producing the crop up to the time of harvesting.

A study of the above account with an acre of ground for a period of five years shows that fertility elements were applied amounting to 156.9 pounds of nitrogen, 244.25 pounds of phosphoric acid, and 440.05 pounds of potash. The fertility elements removed amounted to 552.6 pounds of nitrogen, 233.16 pounds of phosphoric acid, and 636.22 pounds of potash. Balancing the account by subtracting the amount removed from the amount applied we find that 395.70 pounds more nitrogen has been taken off in crops than has been applied in manures and fertilizers. The question arises, where did this nitrogen come from. It is not very probable that there was this amount of available reserve nitrogen in the soil. It is easily explained, however, when we consider the fact that such crops as crimson clover, Canada field peas and cowpeas, which were grown on this plot, take free nitrogen from the air during growth. It is not surprising, therefore, that more nitrogen is removed in the crops than was applied to the soil. Again, referring to the phosphoric acid, we find that 31.26 pounds more has been applied than removed in the crop, so that an excess remains in the soil. In case of the potash 196.17 pounds

more were removed than applied in the manures and fertilizers, so that we have a deficiency of this element in the soil.

Future treatment.—Considering all these conditions, how shall this soil be treated the next season? Taking it for granted that the soil was normal at the start, we should continue to grow some leguminous crop which will utilize the free nitrogen of the air and apply only such amounts of nitrogen as are necessary to give leguminous crops a start and to properly fertilize grains and such crops as cannot take free nitrogen from the air. As to phosphoric acid, the balance shows an excess in the soil and we will only need to apply about the amount that the crop naturally requires. With the potash, however, the balance shows a deficiency in the soil and the application for the next crop should be a liberal one.

Financial balance.—A nominal value has been placed on the crops in order to show a financial balance and to show whether the crops have really been worth more than the expense incurred in growing them. Interest, taxes, and insurance are not included. The cost of harvesting is also omitted, the value being assigned to the standing crops.

On this basis we have a balance for the five years (difference between the cost of production and the value of the crop) of $165.57 or $33.11 per year. A fairly good remuneration. It should be stated, however, that the soil was very ordinary in fertility and that the year before these records began (1896) the plot would not produce over one-half ton of hay to the acre. It may appear to some, also, that the

value of the crops has been rated a little high, but they were cut when in prime condition for feeding and utilized, in some instances, at the season of the year when no other crops were available.

CHAPTER II

THE DAIRY BUSINESS IN RELATION TO SOIL EXHAUSTION

THE keeping of accurate records of all fertility elements applied to the soil in the form of manures and fertilizers and the amount removed in farm crops, as we have seen, is an important matter. We will now look at the subject of the fertility of the dairy farm from a wider viewpoint; and endeavor to show that a dairy farm, in selling market milk and using good business methods in its operations, including the feeding of balanced rations and growing a large percentage of the food stuffs on the farm, will tend to grow richer instead of poorer in plant food. The records used for this purpose were kept by the writer and cover a period of seven years on a farm having about 76 acres under cultivation and a herd of 30 to 40 milking cows.

The following tabulation shows the amount of fertilizing elements contained in the feeds purchased and in the milk produced by the herd. There is shown to be a decided gain to the farm in all the elements of fertility each year. The total gain is equivalent in nitrogen and phosphoric acid to that contained respectively in 27.6 tons of nitrate of soda, 29.6 tons of acid phosphate and in potash to that

KINDS	Amount							Nitrogen						
	1896	1897	1898	1899	1900	1901	1902	1896	1897	1898	1899	1900	1901	1902
	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Lbs.	Lbs.	Lbs.	Lbs.	Lbs	Lbs.	Lbs.
Wheat Bran	9.40	12.50	14.50	15.85	17.00	12.00	14.50	460	612	710	777	833	588	710
Dried Brewers' Grain	9.20	8.15	10.25	13.75	13.05	12.00	17.75	662	587	838	990	940	864	1,278
Corn Meal	6.10	3.30	5.00	7.05	7.50	6.00	1.50	201	109	165	233	248	198	50
Linseed Meal	3.55	4.45	3.50	1.05	.90	1.00	.....	377	478	372	111	95	107	.....
Malt Sprouts	.....	.....	.....	.....	.....	1.50	.....	.....	.....	.....	.....	.....	124	.....
Cottonseed Meal	.....	.....	.....	1.75	4.50	3.00	2.70	.....	.....	.....	238	612	406	365
Gluten Meal	.....	.....	.....	.....	.....	.....	1.50	.....	.....	.....	.....	.....	.....	158
Rice Meal	.....	.....	1.75	2.70	.....	2.40	2.25	.....	.....	69	105	.....	94	110
Pea Meal	.....	.....	.....	.....	1.00	.....	.....	.....	.....	.....	.....	32	.....	.....
Buckwheat Feed	.....	.....	.50	1.60	.....	2.00	.75	.....	.....	36	29	.....	179	68
Total or Gain in Feeds	.....	.....	.....	.....	.....	.....	.....	1,700	1,781	2,190	2,483	2,760	2,560	2,739
Sold in Milk	70.86	77.38	86.36	99.17	97.94	95.65	107.44	849	927	1,036	1,190	1,173	1,146	1,289
Gain to Farm	.....	.....	.....	.....	.....	.....	.....	851	854	1,154	1,293	1,587	1,414	1,450
Total gain in seven years	.....	.....	.....	.....	.....	.....	.....							8,603

(Conclusion on page 16)

(Continued from page 15)

KINDS	Phosphoric Acid							Potash						
	1896	1897	1898	1899	1900	1901	1902	1896	1897	1898	1899	1900	1901	1902
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
Wheat Bran	545	725	841	919	986	691	835	301	402	464	507	544	391	473
Dried Brewers' Grain	202	179	226	303	287	264	391	15	13	17	22	21	19	28
Corn Meal	85	46	70	99	105	84	21	49	26	40	56	60	48	12
Linseed Meal	126	158	124	38	32	38	.....	97	121	96	29	24	28	.....
Malt Sprouts	.....	.....	.....	.....	.....	49	.....	.....	.....	.....	.....	.....	56	.....
Cottonseed Meal	.....	.....	.....	106	275	185	167	.....	.....	.....	66	171	114	103
Gluten Meal	.....	.....	.....	.....	.....	.....	17	.....	.....	.....	.....	.....	.....	2
Rice Meal	.....	.....	94	145	.....	129	122	.....	.....	25	39	.....	35	32
Pea Meal	.....	.....	.....	.....	16	.....	.....	.....	.....	.....	.....	20	.....	.....
Buckwheat Feed	.....	.....	18	58	.....	88	33	.....	.....	13	42	.....	46	18
Total or Gain in Feeds	958	1,108	1,373	1,668	1,701	1,528	1,586	462	562	655	761	840	737	668
Sold in Milk	318	347	389	446	440	429	483	248	271	302	347	343	335	376
Gain to Farm	640	761	984	1,222	1,261	1,099	1,103	214	291	353	424	497	402	792
Total gain in seven years	7,070							2,473						

contained in 2.47 tons high-grade muriate of potash. It is not affirmed that the constituents contained in the manure are equal in agricultural value to those contained in the fertilizers mentioned, or that even under the best conditons of care and application, they could not be used by the plants, but, because the manure contains all the constituents and is well adapted for most crops, the general farmer is, as a rule, able to get as good returns from it in proportion to constituents contained as from products containing the same constituents in more available forms.

The tabulation shows, further, that if all the milk sold from the farm was obtained from foods grown on the farm, the exhaustion of nitrogen would be in greater proportion than the mineral elements, and that when this is the practice it is necessary to apply nitrogenous fertilizers in order to maintain the fertility. If manure is well cared for and used properly, it is more economical to purchase the nitrogen in the form of feeding stuffs, whose whole cost is returned in the increased product resulting from the use of well-balanced rations.

Business methods in maintaining fertility.—Any system of farming must result in the removal of some of the elements of fertility from the soil, but dairy farming properly conducted results in the removal of a minimum rather than a maximum of these elements; provides for the physical and chemical character of soils and is constructive rather than destructive in its effects.

It is the dairy farmer's business to so utilize his crops as to remove from the farm only the minimum

amount of fertility elements in the finished product. For example, experiments have shown that the outgo of fertilizing value in different dairy products from one cow in one year amounts, where butter is sold to .059, where cream is sold to $1.11; where cheese is sold to $4.34; and where milk is sold to $6.68. This does not mean that it is always more profitable from a fertility standpoint for a dairyman to sell butter than milk—the price received for these products must determine which is the most profitable. But where milk is sold, the dairyman should see to it that the fertilizing elements removed from the farm through this channel are restored either by the purchase of commercial feeding stuffs to balance the rations or by direct purchase of manures or commercial fertilizers. The former method will usually prove the more profitable, as it serves the double purpose of feeding the stock and eventually restoring fertility to the soil.

It has been estimated that the fertility in 100 acres of virgin soil is worth $10,000; that the wheat crop would remove from 100 acres in twenty years, $10,000 worth of fertility; and that a herd of eighteen cows in twenty years would restore $10,000 worth of fertility to 100 acres. This herd of cows would not only support the crops grown to feed themselves, but additional fields of twenty acres of corn, and 14 acres of wheat where milk is sold; 24 acres of corn and 18 acres of wheat where cheese is sold; 33 acres of corn and 23 acres of wheat where cream is sold, and 35 acres of corn and 24 acres of wheat where butter is sold.

To illustrate further how dairying, properly conducted, will preserve the fertility of the soil, land on the Pacific Coast reduced to such poverty by the continual raising of wheat that it produced only eight or nine bushels to the acre has been so restored by dairying that it now produces from 20 to 40 bushels and the land has doubled in value. The same may be said of thousands of acres of land which have been continuously planted to corn until it failed to return a profit. Such farmers have had to return to dairying and the keeping of live stock to restore the fertility to the soil.

Continuous growing of corn or wheat is like drawing the principal deposited in the bank until all is gone, while dairying permits a man to live on the interest. The use of commercial fertilizers and the turning under of green crops may be used in conjunction with dairying for maintaining equilibrium in fertility, but the dairy cow will do the work the cheapest. When the crops grown on the farm are fed to live stock and the fertilizer resulting is put back on the land, it is possible to restore to the land 80 to 90 per cent. of the fertilizing elements that were taken from it. The growing of leguminous crops on the farm to be fed to the dairy cows tends to increase the nitrogen content of the soil, since these crops deposit more nitrogen in the soil than is sold in the milk produced by feeding them. This matter of maintaining soil fertility is one of the most important agricultural questions in this country.

PART II—CROPS

CHAPTER I

INTENSIVE SYSTEM OF CROPPING

The losses sustained by a dairyman by reason of scanty pastures during summer droughts are very great. The dairy herd having once fallen in yield of milk for any length of time will rarely recover and return to its normal flow. The dairyman's profits are not only reduced but the dealer or consumer to whom he supplies milk or butter is disappointed and there is trouble all along the line. It is particularly important that the dairyman who retails his milk have a constant supply from day to day and from month to month. The usual and ordinary losses and difficulties could largely be overcome by what is known as the intensive system of dairy farming or the soiling system. This consists in feeding farm animals a succession of green forage crops in the field or stable during the summer period instead of allowing them to run on pasture.

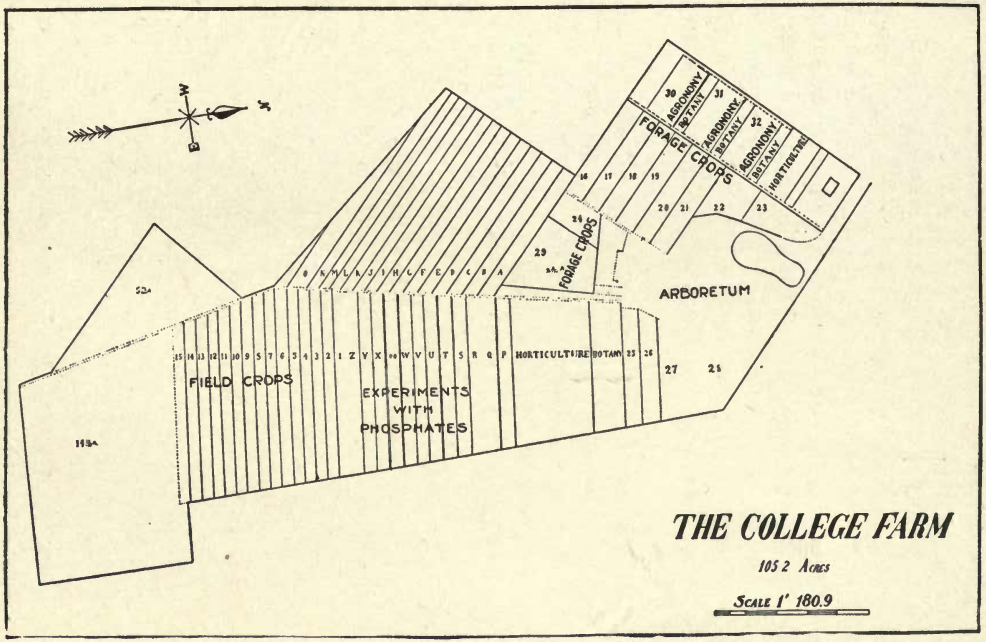
Soiling is especially adapted to localities where the value of land is high and pasture areas are limited. It is adapted to steers as well as to dairy cows. The use of the silo in summer feeding is taking the place of soiling to some extent, as it is used

for supplementary feed to scant pastures during summer droughts.

The production of soiling crops results in intensive methods of farming, as not only large yields are produced from single crops, but two and sometimes three crops are grown upon an acre the same season. (See page 37.) This necessitates heavy applications of manure and fertilizers in order to maintain the fertility of the soil. Green manuring is also practiced in connection with soiling to advantage.

Laying out the farm for soiling.—When forage crops are depended upon entirely as food for the dairy herd in summer, it is a desirable plan to lay out the farm on paper in one or two acre plots (See page 23), decide what crops should be grown, amount and kind of fertilizer to be applied, and figure how much forage can be secured from each acre, allowing for droughts and other unfavorable conditions. He can then calculate the number of cows his farm will carry through the summer.

It may seem, at first, a difficult matter to do this, but by studying thoroughly the productive capacity of the farm for a number of years the calculation can be made almost to a nicety. This calculation can be made during the winter, when the dairyman is less busy with the field work. The seed and the fertilizer need to be ordered, tools put in repair, and everything made ready for the spring work. It has been my experience that land devoted entirely to forage crops will carry three cows per acre for six months from May 1st to November 1st.



SHOWING HOW THE FARM MAY BE LAID OUT TO FACILITATE THE KEEPING OF RECORDS
FROM ANNUAL REPORT NEW JERSEY EXPERIMENT STATION, 1907

The dairyman should, as far as possible, select crops that can be successfully grown on his farm and should avoid those which might contribute an undesirable flavor to his dairy products, as, for example: rape, turnips, etc.

Partial soiling.—This consists in feeding forage crops supplementary to pasturage or to other foods at a time when pastures furnish an insufficient supply. The system is a common practice with many farmers and aids very materially in keeping the milk flow uniform throughout the summer months.

Whether complete or partial soiling is practiced, a succession of crops must be provided which will furnish a continuous supply of forage at the proper stage of growth for feeding as the season advances, or say from May 1st to November 1st. It is a common practice among progressive dairymen to keep the cows in a darkened stable during the day when the pastures are dried up and the cows annoyed by the heat and flies. They are fed forage and some dry coarse foods and grain, and turned out at night.

Crops for soiling.—As it is not the purpose of this book to discuss crops except in so far as they relate to business methods in dairy farming, it will suffice to mention here only a few of the more important of the great variety of crops which have been recommended for soiling.

The following succession was used by the author in New Jersey and would be applicable to other of the Middle Atlantic and the Central States:

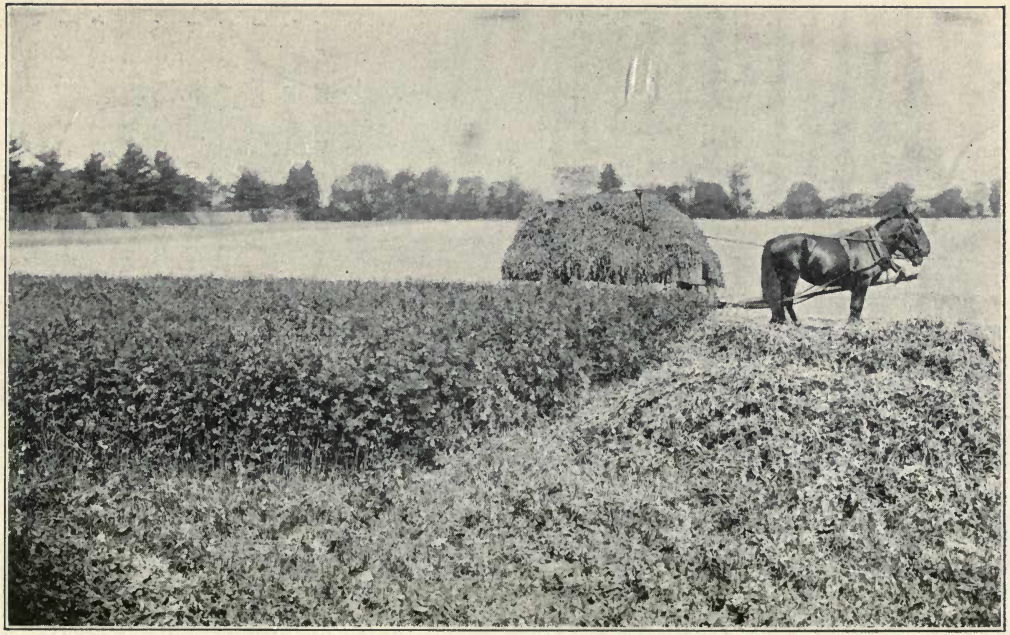
Rye.—The herd was fed a half ration of green rye about May 1st, and in the course of a week a full

ration was supplied with the exception of a small amount of dry roughage once a day, consisting of hay or corn fodder. A cow weighing 1,000 pounds will ordinarily consume from 60 to 70 pounds of the average forage crop a day in addition to a small amount of dry fodder and from six to eight pounds of fine feeds. While the food value of rye is not as great as some of the crops which follow, it is a valuable food for the reason that it comes at a time when no other crop is available.

Wheat immediately follows rye, and while the yield is not usually as great as that obtained from the former crop, it is very palatable, and owing to its larger proportion of leaf growth it remains succulent for a longer time and has proven an excellent forage for the middle of May.

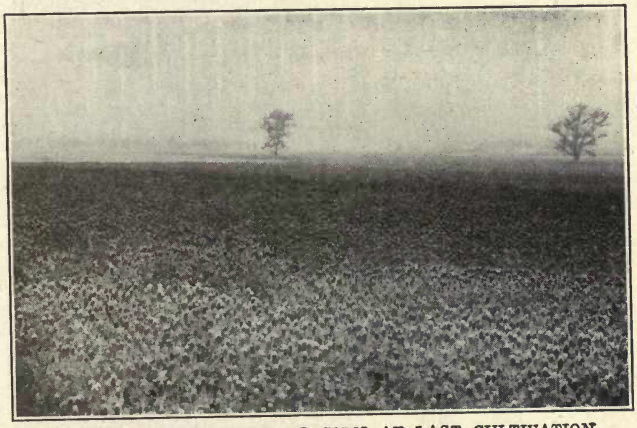
Alfalfa without question is the best perennial crop. It is ready for cutting shortly after the middle of May, and a yield of 20 tons of green forage per acre during a season is not uncommon. An average of 22 tons per acre annually for the four years following seeding has been secured, the greatest annual yield being 26 tons per acre from five cuttings. Owing to its high content of protein (the hay nearly equaling that of wheat bran) it serves an excellent purpose on a dairy farm in materially reducing the need for purchased feeds, whether the crop is fed as green forage or hay.

Crimson clover is one of the most useful crops from the standpoint of yield, composition, cost, and the ease with which it may be secured. It may serve as a pasture where soiling is not practiced, or



HARVESTING ALFALFA IN NEW JERSEY

be made into hay if cut when in early bloom. The crop is usually in the best condition for forage about the first of June.



CRIMSON CLOVER SOWN IN CORN AT LAST CULTIVATION

MIXED GRASSES—A VERY APPETIZING FOOD FOR STOCK

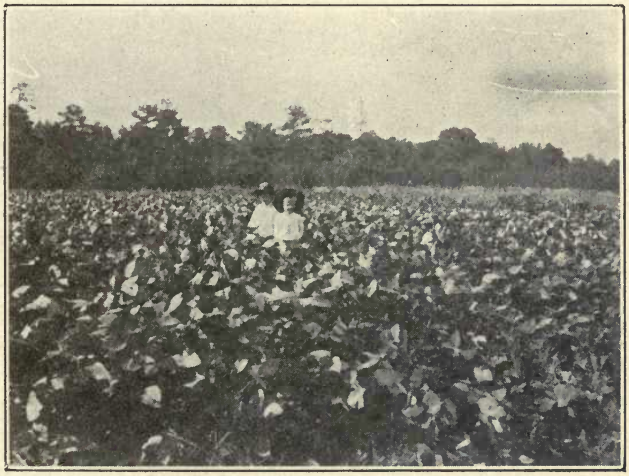
Mixed grasses.—Following crimson clover a mixture of red and alsike clover, timothy (and sometimes red-top added) has been used for feeding with good results early in June. This combination affords a palatable forage and may be fed from ten days to three weeks, depending upon the character of the mixture. There is probably no forage crop that is relished more by dairy animals than this mixture of grasses and clovers, if cut at the proper time.

Peas and oats.—This mixture affords a very serviceable crop and very rarely fails to give a good yield when planted early. It supplies forage when other crops are not usually available, unless large quantities of alfalfa are sown, thus providing a second cutting at this time. It may be seeded at intervals ranging from a week to ten days, the crops being harvested in the order of their maturity. This mixture also makes excellent hay, although more difficult to secure than ordinary grasses. Like alfalfa and crimson clover, it needs to be cured in windrows or small cocks for best results, and when so handled it is of great value as a milk producer. Vetch is sometimes used in place of peas, with equally good results.

Indian corn.—For general forage purposes no annual crop has been found superior to Indian corn. If quick curing varieties are grown, two crops may be obtained in one season from the same area. The thoroughbred White Flint is particularly valuable for forage purposes. It grows very rapidly and branches from the base, thus producing from three to five stalks from a single kernel. This variety also

has a large proportion of leaf and is very succulent. Cows never refuse Indian corn when cut green, and relish it particularly at the stage when the ears are developing.

Cowpeas and soy beans.—These crops possess many desirable characteristics as forage and are very valuable for midsummer feeding. They stand the drought well and will thrive on light, poor soil if



FIELD OF COWPEAS IN ALABAMA

an abundance of mineral elements are provided. They also remain in condition for feeding for a longer time than most crops. Either of these crops may follow peas and oats to good advantage. Aside from forage, they are excellent for green manuring. As to varieties of cowpeas, the Red Ripper is one of the best late varieties and the Southdown Black

and Taylor are among the best for earlier seeding. The Eureka and Green soy beans are among the most profitable kinds.

Millets.—The various millets have an important place in the forage rotation because they grow

BARNYARD MILLET. YIELD, 15 TONS PER ACRE
NEW JERSEY EXPERIMENT STATION

rapidly, mature early, and may be seeded from any time from May until August. The Japanese barnyard millet has proven to be one of the most profitable varieties. The yield during some seasons has reached 13 tons per acre. This crop is often ready for feeding from 45 to 50 days after seeding.

Kaffir corn.—This crop is a good yielder and is often grown with profit. When mixed with cow-

CROP OF COWPEAS AND KAFFIR CORN. YIELD, 13 TONS PER ACRE
NEW JERSEY EXPERIMENT STATION

peas at the rate of one bushel of cowpeas to one-half bushel of kaffir corn per acre and sown in July, yields of 12 tons have been secured. Cowpeas are high in nitrogen, and kaffir corn is a carbonaceous plant. The combination of the two therefore makes a very valuable and nutritious fodder.

Barley.—This is the latest crop to be utilized for soiling. It is not injured by light frost and can be fed throughout October. Barley should be seeded

about August 1st at the rate of two bushels per acre. It is a good practice to seed rye with barley. The rye makes a good growth in the fall after the barley is harvested, holds over the winter well and starts early in the spring.

Additional crops.—Some other crops which have been grown with more or less success are teosinte, sorghum, velvet beans, winter oats, and lupines.

A few standard crops best.—Some dairymen make the mistake of attempting to grow a great variety of forage crops, many of which are uncertain and not adapted to their particular farms. A few standard crops well cared for will usually prove the better plan. For example, rye and wheat for early feeding, followed by large areas of alfalfa (which can be cut three or four times during the summer), and this in turn followed by oats and peas and corn will give a continuous supply if the areas devoted to each were adjusted to the size of the herd. The soiling system may be made still simpler by simply growing alfalfa and corn. With this plan the feeding period could begin about the middle of May and continue until frost.

WHAT CONSTITUTES VALUE IN FORAGE

(1) Yield and composition.—In the case of fine feeds, the amount and quality of the nutrients they contain are taken as the basis in making a comparison of their feeding value. This method is also applicable in comparing the value of forage crops for milk production. The number of tons produced

of any forage is not in itself a safe guide as to its value. For example, corn, at that stage of maturity which would make it a useful crop for feeding green, will contain about 25 per cent. of dry matter, whereas certain millets, Kaffir corn, etc., belonging to the same group of plants, will oftentimes contain as little as 10 per cent. The same is true in the case of the leguminous crops; certain of these are much more watery at the proper stage for feeding than others. This point of variation of dry matter in the different crops should be taken into consideration, together with the other important one, namely, the influence of the proportion of the different nutrients in determining their value. For example, those crops which belong to the cereal group—corn, millet, sorghum, etc.—are carbonaceous in their character, and should be fed in connection with leguminous crops, which supply a larger amount of protein.

Season of the year in which the crop may be grown and time required for it to mature.—There are certain winter annual plants, as rye, wheat and crimson clover, which are very valuable in the forage rotation from the fact that they are available in the early spring. Again, there are other crops which grow best, and can only be grown, in early or midsummer; among these may be mentioned oats and peas, cowpeas and soy beans. Then there are others that are valuable for the reason that they will make considerable growth after the weather becomes cool, as barley, corn and certain of the grasses.

Other plants are valuable from the fact that they will mature in a very short period. In this class are included the various millets, the barnyard variety producing a crop in from 40 to 50 days. The number of plants that will supply forage through the entire growing season is very limited. Alfalfa comes as near to this as any grown in this country. Cuttings from this crop have been made as early as May 12th and as late as October 22d.

Palatability and influence upon the flavor of milk. —A plant that is not palatable is of but little value for forage. Fortunately there are not many that belong to this class. The following are not readily eaten by dairy stock: Yellow and Rural Branching Doura (Millo Maize) and Evergreen Broom-Corn. Animals sometimes refuse to eat certain varieties of peas and beans for a short period, but they soon learn to like them. There is no forage crop which are common, with the exception of Dwarf Essex Rape, that has given an unpleasant flavor to milk when fed judiciously. This crop is not safe to feed to dairy cows. There is the most danger of producing a "grassy" flavor in milk at the beginning of the season, when animals are changed from dry foods to green forage. It sometimes occurs, too, when immature forage is fed. This undesirable effect can usually be overcome by feeding in limited quantities and always after milking.

As already stated, one of the advantages of soiling is that larger yields can be obtained with the system than by pasturing. These are secured in two ways: by increased yields from single crops as a

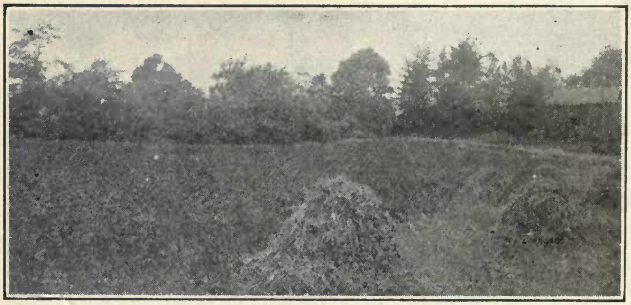
result of careful preparation of the ground and thorough cultivation, and by growing two and sometimes three crops on the same area during a season, taking advantage of the fact that certain crops grow best at certain times of the year.

The following combinations of crops have been found practicable in my experience and show the possibilities of intense farm practice under good average conditions.

Some Practical Forage Rotations—Annual Yield Per Acre

Crops in One year Rotation	Time of seeding	Time of cutting	Yield per Acre. Tons
Rye and Crimson Clover	September	May 1–10	8.05
Oats and Peas	May 10	July 1–10	7.60
Soy Beans	July 10	Sept. 1–10	9.00
Total			24.65
Wheat Fodder	September	May 10–20	7.00
Cowpeas	May 20	July 10–20	8.20
Japanese Millet	July 20	Sept. 10–20	7.00
Total			22.20
Oats and Peas	April 1	June 10–20	7.34
Japanese Millet	June 20	Aug. 1–10	8.73
Barley and Peas	Aug. 10	Oct. 10–20	6.03
Total			22.10
Oats and Peas	April 10	June 1–10	6.80
Cowpeas	June 10	Aug. 10–20	8.20
Barley and Peas	Aug. 20	Oct. 20–30	6.30
Total			21.30
Rye	September	May 1–7	9.60
Cowpeas	June 10	Aug. 25–Sept. 1	10.50
Barley	Sept. 2	Oct. 27–Nov. 1	2.60
Total			22.70
Rye	October	May 7–19	9.60
Soy Beans	June 10	Aug. 19–25	8.80
Barley	Sept. 2	Oct. 27–Nov. 1	2.60
Total			21.00
Crimson Clover	July	May 20–June 1	8.00
Corn	June 1	July 20–Aug. 1	9.56
Total			17.56
Mixed Grasses	September	June 20–30	7.00
Corn	June 20	Aug. 20–Sept. 1	12.24
Total			19.24

Three Crops that may be Grown in Succession on the Same Area the Same Season. (See page 37.)



1ST. CRIMSON CLOVER

2D. PEAS AND OATS

3D. SOY BEANS

Crops in One year Rotation	Time of seeding	Time of cutting	Yield per Acre. Tons
Rye and Vetch	Sept. 10	May 10–19	8.60
Corn	May 27	July 20–29	11.80
Total			20.40
Rye	August	May 1–10	8.50
Pearl Millet	May 18	Aug. 8–15	15.10
Total			23.60
Oats and Peas	Aug. 10	June 16–23	10.20
Cowpeas	Aug. 1	Sept. 16–22	8.00
Total			18.20
Oats and Peas	Aug. 21	June 29–July 6	10.20
Flint Corn	July 10	Sept. 22–30	11.00
Total			21.20
Oats and Peas	April 2	June 26–July 4	6.20
Cowpeas and Kaffir Corn	July 10	Sept. 1–16	12.20
Total			18.40
Alfalfa—First year, two cuttings			8.00
" Second year, four cuttings			20.21
" Third year, five cuttings			26.60
" Fourth year, four cuttings			21.70
" Fifth year, five cuttings			20.11

A Combination of Forage Crops which May Be Grown on the Same Area the Same Season

	Crops in one year rotation	Time of Seeding	Time of Cutting	Yield per acre
				Tons
Combination 1*	Crimson Clover	September	May 1–10	8.05
	Oats and Peas	May 10	July 1–10	7.60
	Soy Beans	July 10	Sept. 1–10	9.00
Total				24.65
Combination 2.	Wheat Fodder.	September	May 10–20	7.00
	Cowpeas	May 20	July 10–20	8.20
	Japanese Millet	July 20	Sept. 10–20	7.00
Total				22.20
Combination 3.	Rye	October	May 7–19	9.60
	Soy Beans	June 10	Aug. 19–25	8.80
	Barley	Sept. 2	Oct. 27–Nov. 1.	2.60
Total				21.00
Combination 4.	Mixed Grasses.	September.	June 20–30	7.00
	Corn	June 20	Aug. 20–Sept. 1	12 24
Total				19.24
Combination 5.	Alfalfa	August	May 15–Oct. 1. (5 cuttings.)	26.60

*See page 36.

CHAPTER II

CUTTING, HANDLING, AND FEEDING FORAGE CROPS

With the exception of corn, forage crops can be cut to advantage with the mowing machine. On large dairy farms, however, a reaper will do the work. Corn may be cut for a small herd by hand, and for large herds with the ordinary corn harvester. In my experience with a herd of fifty animals, the plan followed was to cut about one and one-half tons of forage each morning to supply the herd for the day. This was cut with the mowing machine, requiring from 20 minutes to a half hour, raked with a heavy horse-rake, loaded on a low wagon, and fed to the cows in a two-acre field where they were turned every morning for exercise. Some may object to this method, preferring to feed all the forage in the stable, which was my practice for the evening feeding. However, with a field kept clean and well drained and with plenty of room, the plan worked well. The cows were driven into the stable early in the afternoon and given a light feeding of hay. The barn was darkened to lessen the annoyance of flies, and at this time of day the stable was also much cooler than the field. After being milked, the cows were fed forage in the stalls and turned out again.

With a stable arranged so that a team can be driven through in front of the cows, I should prefer to feed both morning and evening in the stable.

Care should be taken that the cows are kept clean where soiling is practiced, as the animals are not ordinarily as clean as when kept in pasture, for the reason that in the latter case they keep clean naturally. It is important to feed dry hay in connection with the soiling crops, to give the manure a proper consistency and to aid in keeping the stable clean.

Forage as a complete ration.—The advantage of green forage in providing an abundance of roughage throughout the growing season, as well as the relative cheapness of certain of them, makes the question of whether they may not constitute the ration of the entire herd a practicable one—that is, whether it is practicable and profitable to use soiling crops exclusively and thus reduce the necessity for pasturage and for purchased feeds. An experiment was conducted by the writer to learn the influence of a ration composed entirely of forage and its economy as compared with a food consisting of a mixed ration of green forage and fine feed. The forage ration consisted of 100 pounds of oats and peas, while the forage and feed ration was made up of 60 pounds of oats and peas (green), five pounds wheat bran, and three pounds of dried brewers' grains. Notwithstanding the relatively large bulk of the forage ration, the animals consumed it readily and no unfavorable effects upon their health were noticed, though the gain in weight was somewhat less than for the ration consisting of forage and feed. Milk from the forage and feed ration was produced at a cost of 46 cents per hundred, and from the forage ration at a cost of 39 cents per hundred. The results

of the experiment indicated that green forage of the same general composition as oats and peas may serve as the entire ration of dairy cows without injury to the animals, and at a considerable saving in the cost of milk, though the yield may be slightly reduced.

CHAPTER III

TOP DRESSINGS FOR SOILING CROPS

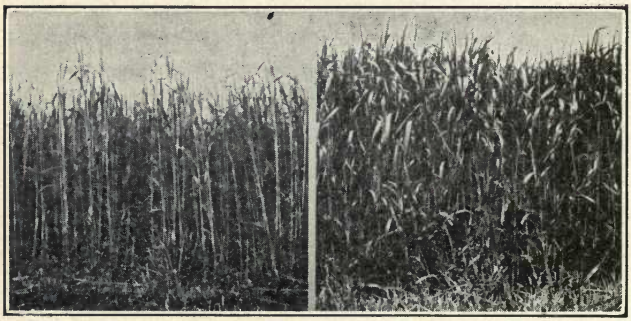
It frequently pays to use top dressings on soiling crops. This, however, is a matter which must be carefully considered by the individual dairyman. My experience has been that with early crops, particularly such as rye and wheat, this method of increasing the yield usually results in a financial gain. Several experiments were conducted to determine this point. The plan was to use two acres in experimenting with each crop, one being treated with nitrate of soda as a top dressing, while the other untreated served in making a comparison. The following table shows the date and amount of application on the different crops and the yield on the treated and untreated plots.

The results indicate that crops of this nature may be very materially increased by applications of nitrate of soda at the rate of 150 to 200 pounds per acre. They also show that the treatment is profitable from a financial standpoint, especially early in the season, when forage is not usually abundant.

AMOUNTS APPLIED AND RESULTS

Kind	Date of Application	Amount of Nitrate Applied	Date of Cutting	Yield		Gain			Cost of Nitrate per Acre	Net Gain
				Untreated Acre	Treated Acre	Tons	Per Cent.	Value at $3.50 per Ton		
		Lbs.		Tons	Tons					
Rye	April 1	150	May 4-16	4.76	6.55	1.79	.376	$5.37	$3.38	$1.99
Rye	April 1	200	May 4-10	5.00	6.70	1.70	.340	5.95	4.50	1.45
*Wheat	April 1	150	May 16-26	4.64	7.50	2.86	.616	8.58	3.38	5.20
Wheat	April 1	150	May 22-31	5.30	6.90	1.60	.313	5.60	3.37	2.23
Barnyard Millet	July 10	160	Aug. 13-22	7.63	13.38	5.75	.754	17.25	3.60	13.65
Mixed Grasses	April 21	200	July 7-9	4.00	5.42	1.42	.355	4.99	4.00	0.99

*See page 42.



UNTREATED PLOT—4.6 TONS PER ACRE TREATED PLOT—7.5 TONS PER ACRE
EXPERIMENT WITH NITRATE OF SODA ON WHEAT

CHAPTER IV

A SUCCESSION OF FORAGE CROPS FOR FIFTY FULL GROWN ANIMALS

THE following table shows a succession of forage crops actually grown at the Experiment Station Farm in New Jersey, and which furnished a continuous supply of forage from May 1st to November 1st, or six months. Data showing the time of planting and harvesting, cost of production and yield are also given in connection with the table. The number of acres used for supplying the 278 tons of forage was 24, 10 of which were used exclusively for forage crops, while the other 13 were only used a part of the season.

A ROTATION OF SOILING CROPS WHICH SUPPLIED FIFTY ANIMALS SIX MONTHS

(N. J. Experiment Station)

KIND	Seed Used. Bus.	Date of Seeding	Period of Cutting and Feeding	Yield. Tons
Rye, 2 acres	4	Sept. 27, 1900	May 1–7	9.4
Rye, 2 acres	4	Oct. 3, 1900	May 7–19	19.2
Alfalfa, first cutting	7-12	May 14, 1898	May 19–25	11.1
Wheat, 2 acres	4	Sept. 26, 1900	May 25–June 1	10.4
Crimson Clover, 6 acres	1 1-5	July 16, 1900	June 1–21	42.8
Mixed Grasses, 1 acre	.....	.....	June 21–26	8.3
Oats and Peas, 2 acres	3 4	April 2	June 26–July 4	12.4
Oats and Peas, 2 acres	3	April 11	July 4–9	8.2
Alfalfa, second cutting	.....	.....	July 9–11	2.1
Oats and Peas, 5 acres	10 7½	April 19	July 11–22	16.4
Southern White Corn, 2 acres	½	May 2	July 22–Aug. 3	17.7
Barnyard Millet, 2 acres	1⅜	June 19	Aug. 3–19	23.2
Soy Beans, 1 acre	2	June 10	Aug. 19–25	8.8
Cowpeas, 1 acre	2	June 10	Aug. 25–Sept. 1	10.5
Cowpeas and Kaffir Corn, 2 acres	2 1	July 10	Sept. 1–16	24.4
Pearl Millet, 2 acres	¼	July 11	Sept. 16–Oct. 1	20.2
Cowpeas, 1 acre	1½	July 24	Oct. 1–5	8.0
Mixed Grasses, 5 acres (partly dried)	.....	.....	Oct. 5–27	20.0
Barley, 2 acres	3½	Sept. 2	Oct. 27–Nov. 1	5.2
Total	.....	.....	.....	278.3

CHAPTER V

VALUE OF FORAGE CROPS PER ACRE COMPARED WITH CLOVER HAY AND WHEAT BRAN

THE arrangement of crops (see page 45) furnished a continuous supply of forage for the dairy herd From May 1st until Nov. 1st. The wheat on acres 3, 4, and 5, the alfalfa on acre 8, and the crimson clover on acres 13, 14, and 15, were used for green manure. The total yield per acre for all crops in the year's rotation shows a profitable return. Leaving out of consideration the crops that were turned under, and the mixed grasses, which were not in the regular rotation, six acres yielded less than ten tons, eleven acres yielded more than ten tons and less than fifteen, four yielded over fifteen and less than twenty, while one yielded over twenty tons. The average yield per acre for the crops in the regular rotations, not including those turned under, was 12.15 tons.

SOILING CROPS—KIND, YIELD AND NUTRIENTS

Acre No.	Crop Rotation	Yield per Acre	Nutrients		
			Protein	Ether Extract	Fiber and N. free Extract
		Tons	Lbs.	Lbs.	Lbs.
1	Rye	6.70	347.73	80.4	2,441.95
	Cowpeas and Millet	9.05	364.80	154.2	3,162.00
	Total	15.75	712.53	234.6	5,603.95
2	Rye	5.00	259.50	60.00	1,822.35
	Cowpeas and Millet	10.05	417.36	172.19	996.09
	Total	15.05	676.86	232.19	2,818.44
3	*Wheat	.....	.....	.....	.....
	Peas and Oats	5.55	588.30	72.15	1,143.30
	White Flint Corn	7.00	231.00	86.80	2,316.30
	Total	12.55	819.30	158.95	3,459.60
4	*Wheat	.....	.....	.....	.....
	Peas and Oats	5.55	588.30	72.15	1,143.30
	White Flint Corn	7.00	231.00	86.80	2,316.30
	Total	12.55	819.30	158.95	3,459.60
5	*Wheat	.....	.....	.....	.....
	Peas and Oats	5.34	556.04	69.42	1,100.04
	White Flint Corn	7.00	231.00	86.80	2,316.30
	Total	12.34	787.04	156.22	3,416.34
6	Crimson Clover	4.15	255.00	42.50	969.00
	Cowpeas and Kaffir Corn	3.60	97.20	39.60	1,004.40
	Seeded to Alfalfa, August 13th	.....	.....	.....	.....
	Total	7.75	177.05	61.00	1,849.00
7	Crimson Clover	4.25	255.00	42.50	969.00
	Cowpeas and Kaffir Corn	4.00	108.00	44.00	1,116 00
	Seeded to Alfalfa, August 13th	.....	.....	.....	.....
	Total	8.25	363.00	86.50	2,085.00
8	*Alfalfa	.....	.....	.....	.....
	Barnyard Millet	13.60	435.20	240.80	5,807.20
	Reseeded to Alfalfa, August 6th	1.00	83.00	18.00	323.00
	Total	14.60	518.20	258.80	6,130.20
9	Wheat	10.34	597.04	186.12	3,701.72
	Sweet Corn	5.00	177.05	61.00	1,849.00
	Total	15.34	756.09	247.12	5,550.72
10	Wheat	10.34	579.04	186.12	3,701.72
	Cowpeas	6.04	347.90	93.02	1,208.00
	Total	16.38	926.94	279.14	4,909.72
11	Rye	4.24	220.48	50.88	1,543.36
	Vetch and Oats	5.10	339.52	112.54	2,292.28
	Barley	3.40	183.60	40.80	1,074.00
	Total	12.74	743.60	204.22	4,909.64

(Concluded on page 46)

*Used for green manure.

SOILING CROPS—KIND, YIELD AND NUTRIENTS

(Continued from page 45)

Acre No.	Crop Rotation	Yield per Acre	Nutrients		
			Protein	Ether Extract	Fiber and N. free Extract
		Tons	Lbs.	Lbs.	Lbs.
12	Rye	4.24	220.48	50.88	1,543.36
	Vetch and Oats	5.10	339.52	112.54	2,292.28
	Barley	3.40	183.60	40.80	1,074.00
	Total	12.74	743.60	204.22	4,909.64
13	*Crimson Clover				
	Peas and Oats	7.30	773.80	90.52	2,415.57
	Barley	4.00	216.00	48.00	1,264.00
	Total	11.30	989.80	138.52	3,679.57
14	*Crimson Clover				
	Peas and Oats	6.30	667.80	81.90	1,297.80
	Barley	3.30	178.20	39.60	1,042.80
	Total	9.60	846.00	121.50	2,340.60
15	*Crimson Clover				
	Peas and Oats	6.60	699.60	85.80	1,359.60
	Sorghum	2.50	68.00	25.50	587.50
	Total	9.10	767.60	111.30	1,947.10
16	Wheat	6.90	386.40	124.20	2,470.20
	Barnyard Millet	2.75	88.00	49.50	1,174.25
	Total	9.65	474.40	173.70	3,644.45
17	Wheat	5.30	296.80	95.40	1,897.40
	Barnyard Millet	2.00	64.00	36.00	854.00
	Total	7.30	360.80	131.40	2,751.40
18	Alfalfa	21.36	1,775.02	378.07	6,900.42
19	Alfalfa	11.15	925.45	200.70	3,601.45
20	Crimson Clover	9.00	540.00	90.00	1,971.00
	Corn	21.73	572.59	193.57	7,983.60
	Total	30.73	1,112.59	283.57	9,954 60
21	Mixed Grasses	12.20	1,146.80	292.80	5,124.00
	Mixed Grasses (second crop)	20.08	1,887.52	481.92	8,433.60
	Four tons clover hay contains		1,080	264	5,040
	Three " " " "		810	198	3,780
	Two " " " "		540	132	2,520
	Three tons wheat bran contains		924	246	3,240
	Three tons corn meal "		558	228	4,200

*Used for green manure.

CHAPTER VI

SUCCESSION OF FORAGE CROPS IN DIFFERENT STATES

THE tables shown in this connection will serve as guides to the dairymen in these particular States. While it is not expected that any of these systems can be followed in detail, they may prove useful.

EXAMPLES OF ROTATIONS OF SOILING CROPS

Soiling Crops Adapted to Northern New England States—Lindsey. (For 10 Cows, Entire Soiling)

KIND	Seed per Acre	Time of Seeding	Area	Time of Cutting
Rye	2 bushels	Sept. 10–15	½ acre	May 20–May 30
Wheat	2 bushels	Sept. 10–15	½ acre	June 1–June 15
Red Clover	20 pounds	July 15–Aug. 1	½ acre	June 15–June 25
Grass and Clover	½ bus. Red Top, 1 peck Timothy, 10 lbs. Red Clover	September	⅔ acre	June 15–June 30
Vetch and Oats	3 bus. Oats, 50 lbs. Vetch	April 20	½ acre	June 25–July 10
Vetch and Oats	3 bus. Oats, 50 lbs. Vetch	April 30	½ acre	July 10–July 20
Peas and Oats	1½ bus. Canada Peas, 1½ bus. Oats	April 20	½ acre	June 25–July 10
Peas and Oats	1½ bus. Canada Peas, 1½ bus. Oats	April 30	½ acre	July 10–July 20
Barnyard Millet	1 peck	May 10	⅓ acre	July 25–Aug. 10
Barnyard Millet	1 peck	May 25	⅓ acre	Aug. 10–Aug. 20
Soy Beans (medium green)	18 quarts	May 20	⅓ acre	Aug. 25–Sept. 15
Corn		May 20	⅓ acre	Aug. 25–Sept. 10
Corn		May 30	⅓ acre	Sept. 10–Sept. 20
Hungarian	1 bushel	July 15	½ acre	Sept. 20–Sept. 30
Barley and Peas	1½ bus. Peas, 1½ bus. Barley	Aug. 5	1 acre	Oct. 1–Oct. 20

SOILING CROPS FOR PENNSYLVANIA

Watson & Mairs

Crop	Area for 10 Cows	When to be Fed
Rye	½ acre	May 15–June 1
Alfalfa	2 acres	June 1–June 12
Clover and Timothy	¾ acre	June 12–June 24
Peas and Oats	1 acre	June 24–July 15
Alfalfa (second crop)	2 acres	July 15–Aug. 11
Sorghum and Cowpeas (after Rye)	½ acre	Aug. 11–Aug. 28
Cowpeas (after Peas and Oats)	1 acre	Aug. 28–Sept. 30

CROPS FOR PARTIAL SOILING FOR ILLINOIS DURING MIDSUMMER—Fraser

Kinds of Fodder	Amount Seed per Acre	Approximate Time of Seeding	Approximate Time of Feeding
1. Corn, early, sweet and dent	6 quarts	May 1	July 1–Aug. 1
2. Corn, medium dent	5 quarts	May 15	Aug. 1–Sept. 30
3. Cowpeas	1 bushel	May 15	Aug. 1–Sept. 15
4. Soy Beans	1 bushel	May 15	Aug. 1–Sept. 15
5. Oats and Canada Peas	1 bushel each	April 15	July 1–July 15
6. Oats and Canada Peas	1 bushel each	May 1	July 15–Aug. 1
7. Rape (Dwarf Essex)	4 pounds	May 1	July 1–Aug. 1
8. Rape, second sowing	4 pounds	June 1	Aug. 1–Sept. 1
9. Rape, third sowing	4 pounds	July 1	Sept. 1–Oct. 1

SUCCESSION OF SOILING CROPS FOR DAIRY COWS FOR WISCONSIN—Carlyle

Crop	Pounds of Seed per Acre	Time for Sowing	Approximate				Degrees of Maturity	Palatability
			Time of Cutting	Days from Sowing to Harvest	Daily Feed for Cow	Average for Ten Cows		
Fall Rye	168	Sept. 10....	May 15–June 1...	248	38	⅓	Before blooming..	Poor.
Alfalfa	20	Mar. 20....	June 1–15.....	72	36	⅓	Before blooming..	Fair.
Red Clover	15	.....	June 15–25.....	.....	36	⅓	In bloom.....	Fair.
Peas and Oats	P 60 O 48	April 16....	June 25–July 5...	70	32	1-6	In milk.....	Average.
Peas and Oats	P 60 O 48	April 26....	July 5–15.....	70	32	1-6	In milk.....	Average.
Oats	80	May 5.....	July 15–25.....	70	32	1-6	In milk.....	Average.
Alfalfa (second crop)	.....	.....	July 15–30.....	.....	36	.....	Before blooming..	Average.
Rape	2.5	May 26....	Aug. 1–15.....	67	42	⅛	Mature	Good.
Flint Corn	.....	May 20....	Aug. 15–25.....	86	40	⅛	In silk	Very good.
Sorghum	50	June 1.....	Aug. 25–Sept. 10.	86	39	1-10	When well headed	Very good.
Evergreen Sweet Corn	.....	May 31....	Sept. 10–25	102	39	⅛	In silk	Very good.
Rape	2.5	July 20....	Sept. 25–Oct. 10..	67	42	⅛	Mature	Good.

Remarks.—Feed in stable during day and turn cows on pasture at night, or feed in the pasture, spreading the forage. After cutting rye, use same ground for the rape, flint corn and sorghum, and after cutting peas and oats, use same ground for evergreen sweet corn and rape. After oats, sow peas and barley. In this way a single acre only is required (except alfalfa, which is permanent) and the forage produced is ample amount of good succulent feed for ten cows for nearly half a year.

DATES FOR PLANTING AND USING SOILING CROPS IN WESTERN OREGON AND WESTERN WASHINGTON—Hunter

CROPS	When Planted	When Used
Rye and Vetch	September 1–15.	April 1–May 15.
Winter Oats and Vetch.	Sept. and Oct..	May 15–July 1.
Winter Wheat and Vetch	Sept. and Oct..	May 15–July 1.
Red Clover	.....	May 15–July 1.
Alfalfa	.....	During June.
Oats and Peas	February	During June.
Oats and Vetch	February	June 15–July 15.
Oats and Peas	April	During July.
Rape	May 1.....	During July.
Oats and Peas	May	During August.
Rape	June	During August.
Corn	May 10–20.....	During Aug., Sept. and Oct.
Turnips	July 1.....	Late fall and early winter.
Thousand Headed Kale.	March 15 and trans. June 1..	Oct. 15–April 1.
Mangels, Carrots and Rutabagas	April	Oct. 15–April 1 (fed from bins, pits or root-houses.

CHAPTER VII

ADVANTAGES AND DISADVANTAGES OF SOILING

ADVANTAGES

(1) **Less land required.**—Any system which increases the productive capacity of the soil reduces the acreage required to maintain the same number of cattle.

(2) **Less fencing required.**—Aside from a small field for exercise, it is not necessary for the cows to run at large. Hence the fences can be disposed of, saving much expense for their maintenance. This also throws the farm into larger areas for cultivation, saving time in turning with teams during planting, cultivating, etc.

(3) **Increased food production.**—The amount of food produced by soiling frequently exceeds three times that from pasture, as every square foot of the farm is kept at its highest productive capacity undisturbed by the treading of animals.

(4) **Greater variety of food.**—The succession of crops provides changes in the ration which are usually much appreciated by the animals, keeping their appetites good and favoring a large consumption of food.

(5) **Less waste.**—Animals on pasture waste much food by constant tramping, by manure dropping and by lying on it. Some of the pasture grasses become old and unpalatable, while in the soiling system, plants are cut at the proper time, insuring palatability.

(6) Less discomfort and better condition of the animals.—With the soiling system the animals can be kept in the stable during the heat of the day, where they may be protected from flies, and instead of racing over scanty pastures to secure the proper amount of food, they are fed regularly and liberally.

(7) Increased milk and better production.—The soiling system favors the production of a large and even flow of milk, so important in the retail milk business, hence more profit.

(8) Increased quantity and better quality of manure.—The animals are kept in the stable more of the time, where the manure is saved and preserved without waste. Where soiling is practiced it is important that the land be rich, hence the saving of manure is particularly valuable in connection with this class of farming. This saving of the manure alone frequently pays for the extra expense incurred in raising and handling the soiling crops.

DISADVANTAGES

(1) Increased labor required.—The soiling system requires much extra labor in preparing the soil and planting and harvesting the various crops and in feeding the herd. The crops must be planted at the proper time and green feed cut and placed before the animals daily, regardless of the weather and other farm work which may be very urgent.

(2) More practical knowledge of crops required.—For successful soiling, careful planning and much forethought and study are necessary, which does not need to be considered with the pasture system.

CHAPTER VIII

SOILING vs. SILAGE

It has been my experience that the production of milk from soiling crops, supplemented with five or six pounds of hay and six to eight pounds of grain of the proper kind to make a balanced ration, has been practically the same as when a ration of silage has been fed properly balanced with from six to eight pounds of grain.

The results of the two systems where soiling crops were fed from May 1st to November 1st and silage for the remaining six months are shown in the accompanying table. Only those animals which remained in the herd the entire year are included in the record.

The tabulation shows that during the period of seven years with a herd averaging 23 cows there is a difference in the average yearly milk yield for the herd of 378 pounds, which is in favor of soiling. This difference, however, only amounts to about 16 pounds a year for each cow, which is hardly worth considering. The difference in the annual butter yield of the herd amounted to about 16.8 pounds in favor of soiling, or less than one pound a year for each animal. The difference in the average per cent. of fat from the two systems is perhaps of most interest, but this proved to be practically the same, being 4.31 per cent. for the soiling period and 4.38 per cent. for the silage period. The number of fresh cows each month during the year was quite uniform,

SUMMARY RECORD OF THE DAIRY HERD, SHOWING AVERAGE YIELDS OF MILK AND FAT DURING THE SOILING AND SILAGE PERIODS

Year	Number of Cows	Soiling Period. May 1st—November 1st				Silage Periods November 1st—May 1st			
		Average Yield per Cow of—				Average Yield per Cow of—			
		Milk	Fat	Butter	Fat	Milk	Fat	Butter	Fat
		Lbs.	Lbs.	Lbs.	%	Lbs.	Lbs.	Lbs.	%
1897.....	21	3,414	144.5	168.6	4.23	2,941	123.1	143.6	4.18
1898.....	20	3,174	140.7	164.2	4.43	2,970	132.0	154.0	4.44
1899.....	12	3,889	164.3	191.7	4.23	3,078	137.8	160.8	4.48
1900.....	27	3,390	153.4	179.0	4.53	2,975	137.2	160.1	4.61
1901.....	26	3,250	137.1	160.0	4.22	3,287	144.2	168.2	4.39
1902.....	30	3,624	153.8	179.4	4.24	3,046	127.7	149.0	4.19
1903.....	26	3.076	133.7	156.0	4.35	2,871	124.9	145.7	4.35
Average	23	3,402	146.8	171.3	4.31	3,024	132.4	154.5	4.38

hence the comparison of yields from the two systems is a fair one and shows that both systems are practicable in respect to the quantity, as well as the quality, of the product produced. On small farms, where it is desired to keep the largest herd possible, it is necessary that every acre be made to produce to its highest capacity. The above systems of summer and winter feeding doubtless come the nearest to accomplishing this.

PART III—THE DAIRY HERD

CHAPTER I

SELECTING THE BREED, FROM A BUSINESS STANDPOINT

With the dairy farmer the breed should be chosen from a business standpoint. Dairymen are too often careless and indifferent in regard to this matter, hence fail in building the very foundation of their business. In selecting the breed it is necessary that the dairyman bear in mind its adaptability to the particular line of dairying he intends to follow; that is, whether a retail milk business where the customers demand a high quality and are willing to pay for it; whether a wholesale milk business where quality is of little importance and the price is low; whether a breed is wanted for the production of butter on the farm for local trade, or whether a good all-around family cow is wanted. Again a breed should be adopted to the general conditions of the farm. If the farm is made up of large areas of rough stony pastures, a breed that is a good rustler will be more profitable than one that is not. The point should also be considered whether the dairyman is going to make it his chief business to breed and sell pure bred stock or whether the production of milk and butter is to have the first consideration.

Some dairymen in selecting a breed look for a "general purpose" or dual purpose cow, or a cow from a specially developed milk producing family of the beef breeds, or grades of such stock, the claim being that even if such animals are not so productive while in the dairy, their meat-producing tendencies offset this. The dual purpose cow, however, is too apt to prove a no-purpose cow. The consensus of opinion among those who are strictly in the dairy business is, that under most conditions, cattle of the distinct dairy type specially developed for dairy purposes are best. Owners of the so-called "special purpose" cows expect the dairy products to give such profitable returns that the beef producing qualities of the cow can be entirely ignored. In any case the selection of the breed should be with a view to profit, and this selection must be determined by local conditions.

Special adaptations.—While it is claimed for two or three breeds of cattle that they possess the combined qualities of meat and milk, there are a number of families and breeds which have marked characteristics distinguishing them as milk and butter producers. With this great variety, a dairyman who is ambitious can find and select cows well adapted to his particular conditions. Some breeds are noted for the quantity of milk they produce, others for the richness of their milk and the color of their product, whether milk, cream or butter. Certain individual cows combine quantity and quality in a marked degree. Some breeds are very active and thrive on a wide range of scanty pasture and consume coarse

foods with profit in winter. There are other breeds which do better when more closely confined and subjected to high feeding. Some cows give a heavy flow of milk for a short period and others are more persistent, giving a good flow throughout the year. Many of these different characteristics pertain to dairy breeds, so that a dairyman knowing what he wants, can choose his breed without pronounced opinions or direct advice from others. There is no one best breed for all. The best breed is the breed best suited to each individual dairyman's needs. It is simply a question of making a proper study of the subject, and no dairyman has to go far in this country to find a good breed for milk production, for the cream trade or for butter-making. It has been demonstrated that the best cow for butter is also the best cow for cheese.

It will not be out of place to mention briefly, in this connection, some of the characteristics of the breeds most prominent in the dairy world to-day. Let us have clearly in mind at the outset what a breed is. We recognize a class of animals as a breed when they have been subjected to and reproduced under the same conditions until they have acquired a distinctive character common to all members, which reproduces with very slight variations.

PRINCIPAL DAIRY BREEDS

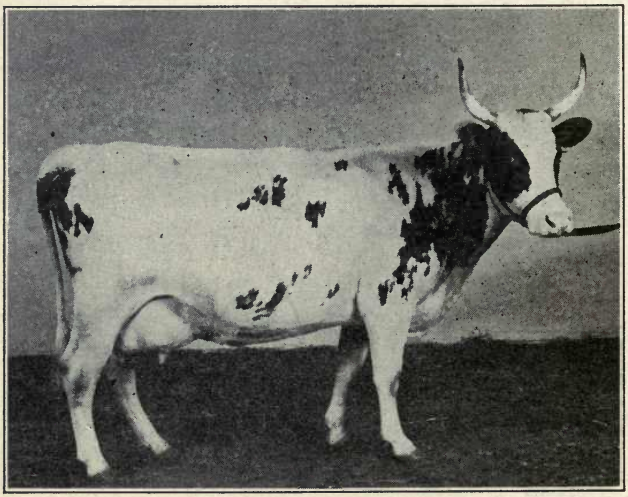
Ayrshire.—A breed adapted to the rougher and less fertile sections of the country, for the reason that they originated in the county of Ayr, Scotland, a region of moderate fertility, with natural pas-

turage so distributed that grazing animals had to travel long distances to satisfy their hunger. They excel in their ability to obtain subsistence and thrive on a wide range of scanty pasture and in giving a dairy profit on coarse forage. They are tough and hardy and stand rough weather better than most other breeds. In perfecting the breed the end sought has been a large yield of milk without extravagance of food. The Ayrshire cows are of medium size, averaging about 1,000 pounds at maturity. They are short legged, fine boned, very active and of a somewhat nervous temperament. The Scotchman has worked for quality in the udder for a long time, with the result that the full udder of the Ayrshire has come to be regarded as a model in shape. The teats, however, are a little too small for easy milking, but careful breeders remedy this defect. The Ayrshire cow is a large and persistent milker, occupying middle ground between the Holsteins as large producers and the Jerseys and Guernseys as rich producers. One noted herd has an unbroken record for nineteen years with an average product of 6,407 pounds a year to the cow. Some individual cows have exceeded 12,000 pounds in one year. Large butter records are not numerous, but some individual cows have reached 500 and even 600 pounds.

The milk of the Ayrshire is not exceptionally rich but somewhat above the average. Herd records average from 3.5 to 4.0 per cent. of butter fat throughout the year, the average for the breed being about 3.8. Ayrshire milk is very uniform in its

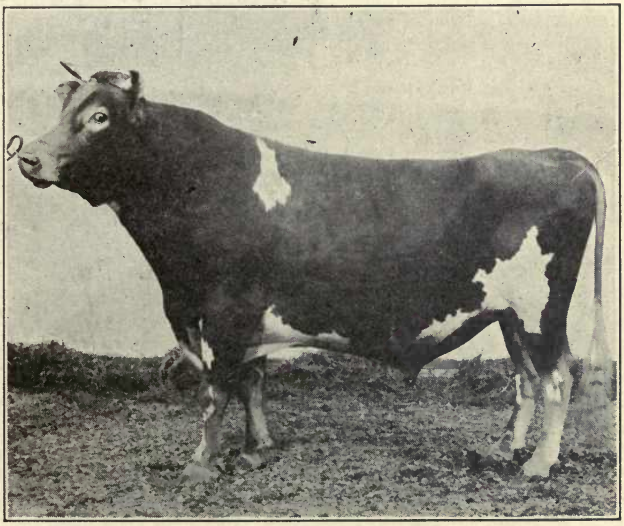
physical character. The fat globules are small, even in size and do not separate freely from the milk. Cream, therefore, rises slowly and has comparatively little color. The Ayrshire is therefore noted more especially as a milk breed, the milk being ordinarily suited for city supply. It stands long transportation without churning or injury. The Ayrshire may be fairly classed as one of the prominent dairy breeds.

Guernsey.—The shrewd, careful people of the island of Guernsey have developed this breed, which is known the world over for producing butter of the highest natural color and with small outlay for food. Taking a look at her we see an animal weighing



GRAND CHAMPION AYRSHIRE COW, NATIONAL DAIRY SHOW, CHICAGO, 1906

from 900 to 1,200 pounds and giving the impression at once of an animal of the dairy type built for the butter-making business. The udder and teats are large and well placed in select specimens. Not only is the butter from the breed of rich golden color, but the milk and cream as well. For this reason these products are highly prized by the critical consumer. The cows produce liberal quantities of milk of uncommon richness in butterfat and natural color. They are valuable butter cows and at the same time good animals for market milk where quality secures a relatively high price, and they are noted for rich production combined with especial economy in feed-



FIRST PRIZE THREE-YEAR-OLD GUERNSEY BULL, PAN-AMERICAN EXPOSITION

ing. In their native land the average herd is expected to produce 5,000 pounds of milk and 300 pounds of butter in a year. In this country, where the animals are more highly fed, many herds exceed 6,000 pounds of milk and 400 pounds of butter.

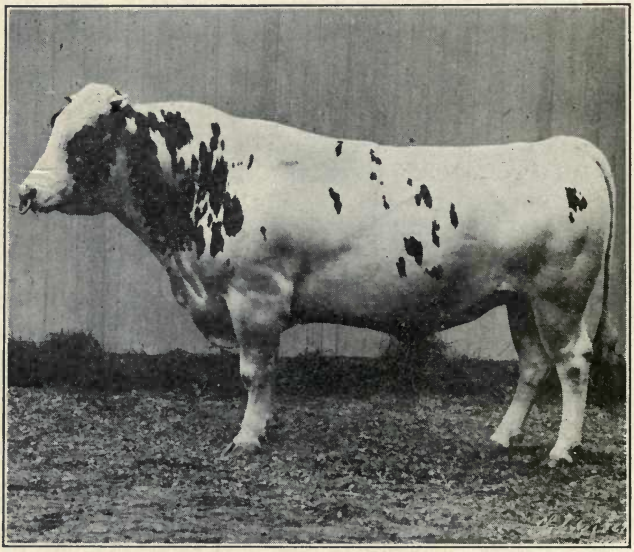
GUERNSEY COW, "YEKSA SUNBEAM." RECORD, 1,000 POUNDS BUTTER IN ONE YEAR

Single cows have records of over 14,000 pounds of milk, and one has reached an equivalent of 1,000 pounds of butter in a year under official test. The Guernsey and her sister, the Jersey, rank as the leading butter breeds in this country.

Holstein-Friesian.—These black and white animals, introduced from the provinces of North Holland and Friesland, constitute one of the oldest of

the dairy breeds. This breed excels in milk production. The animals are also characterized by their large frame, fine bone (compared with the size of the breed), abundance of flesh, silken coat and extreme docility. The object of the early breeders was to produce as much milk and beef as possible from the same animal, and this is still the object of many of the breeders of these animals to-day. Their big bony frames are usually well filled out and are thus readily turned into beef. The calves are large at birth and they usually grow and fatten with great rapidity. For this reason the heifers develop and mature early. The calves are usually raised with little difficulty. In size the Holsteins are the largest of all the dairy breeds. Mature cows range in weight from 1,200 to 1,500 pounds and sometimes reach 1,800. The bulls at maturity are very large, often above 2,500 pounds, and usually possess a vigorous constitution. As already stated, one of the prominent characteristics of this breed is the large milk production. The udder is often of extraordinary size with teats of good form and well placed. The milk veins are frequently remarkably developed. The cows are generally of the true dairy type. Records are numerous of cows giving an average of above their own live weight in milk monthly for over twelve consecutive months, and there are authentic instances of daily yields of 100 pounds or more for several days in succession, and 20,000 to 30,000 pounds of milk in one year. Many herds produce an average of 8,000 pounds per cow a year, and some 10,000. One of the most serious defects in

this breed is the low percentage of fat and total solids in the milk. The cows have been favorites for dairymen doing a milk supply business, but in numerous instances their product has been below the standards fixed by State and municipal laws.



HOLSTEIN BULL, "COUNT PAUL DE KOL, 2D," FIRST PRIZE THREE-YEAR-OLD, PAN-AMERICAN EXPOSITION

It should be stated, however, that many breeders are working toward a higher fat content with considerable success, and many families of this breed produce milk which exceeds 4.0 in fat and are profitable butter producers. The fat globules are small and of uniform size, separating slowly by the gravity method of creaming and carrying very little

color. There are several yearly records of butter production of herds exceeding 400 pounds per head, and single cows have exceeded 600 pounds. The Holstein cow Aggie Cornucopia Pauline has an official 7-day record of 27.459 pounds of butter fat,

HOLSTEIN COW, "COLANTHA 4TH JOHANNA," CHAMPION BUTTER COW OF THE WORLD, 1,164.63 POUNDS IN A YEAR

equivalent to 32.03 pounds of butter. To do their best this breed must have an abundance of rich food without the necessity of much exertion to obtain it. As stated at the outset, the dairyman must select the breed best suited to his conditions. The Holsteins with the Ayrshires rank as the foremost milk breeds.

Jersey.—This is one of the most important and widely distributed of the dairy breeds of cattle in

this country. Developed on the Island of Jersey, it is delicate and gentle with well-established characteristics. The animals are light, quick and graceful in movement, and are often spoken of as "deer-like" in appearance and action. The color is variable from black to brown and tan to fawn. The blood of the Jersey is almost unmistakably shown by signs or markings, whether pure bred or grade. A valuable characteristic of this breed is prepotency or transmission of form, constitution and function to offspring, these having been established by many generations of pure breeding. The Jersey is noted as a butter breed. The milk produced is, as a rule, richer in fat and solids than that of any other breed, but the quantity yielded, on the other hand, is apt to be lower. The milk from Jerseys often contains over 6 per cent. of fat, and the average for the breed is close to 5 per cent. The fat globules in the milk are large, causing the cream to separate quickly, which is quite an advantage, particularly where the gravity system is used. The Jerseys are second only to the Guernseys in the abundant secretion of coloring matter, which shows itself in the skin and on various parts of the body and gives a rich tint to milk and cream and a golden hue to the butter.

The typical Jersey generally has a high-strung nervous temperament. They must therefore receive good care if best results are to be secured. That is, they cannot be abused as to feed and treatment without injury. They are therefore most likely to prove a success in the hands of intelligent dairymen who take an interest in their stock. The dairy type

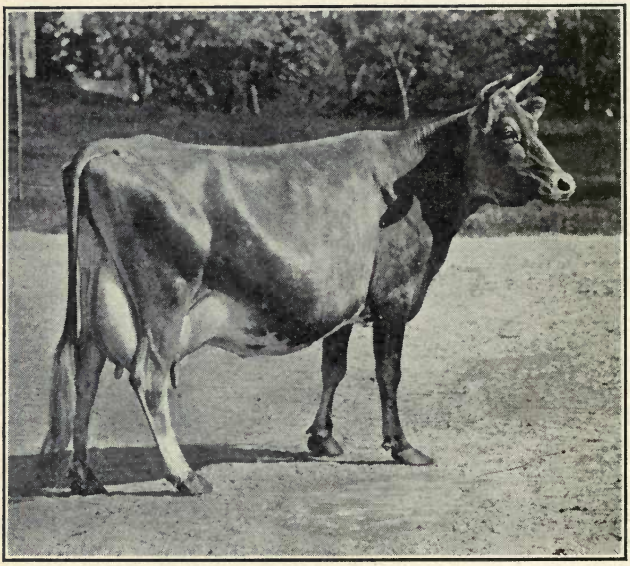
predominates, showing a wedge-shaped, deep-chested body, good digestive organs, large full udders, well-developed milk veins, and a soft, mellow skin. The cows are gentle and docile when well treated, while the bulls have a reputation of being hard to handle and sometimes ugly and dangerous. This, however, depends largely upon their early treatment and training. While the Jerseys are the smallest in average size of the noted dairy breeds, certain strains of Jerseys reach a good weight.

On their native island the Jerseys have been bred especially and almost exclusively for butter. In America breeders have striven with some degree of success to increase the milk yield while maintaining its high quality. The cows are noted for persistence in milking, making a long season of profit. Many herds average 5,000 to 6,000 pounds of milk annually, and single cows have reached 14,000 and even 16,000 pounds. Jersey butter records usually make a good showing, and good herds average 350 to 400 pounds of butter annually, and single cows have exceeded 600 pounds. Confirmed tests of 20 pounds of butter in seven days have been recorded.

The man more important than the breed.—It is possible to select any one of the principal breeds of dairy cows and consider it from the most favorable standpoint and make it appear to be the best breed. On the other hand it is just as easy to discuss these same breeds individually from their most unfavorable standpoint and make them appear very undesirable for dairy purposes. The writer, however, has tried to give them all fair treatment. The fact

is, there are most excellent cows in all of these breeds, and success will depend more upon the intelligence of the man behind the breed who studies his conditions, than upon the breed itself.

Some other breeds that have marked dairy quali-



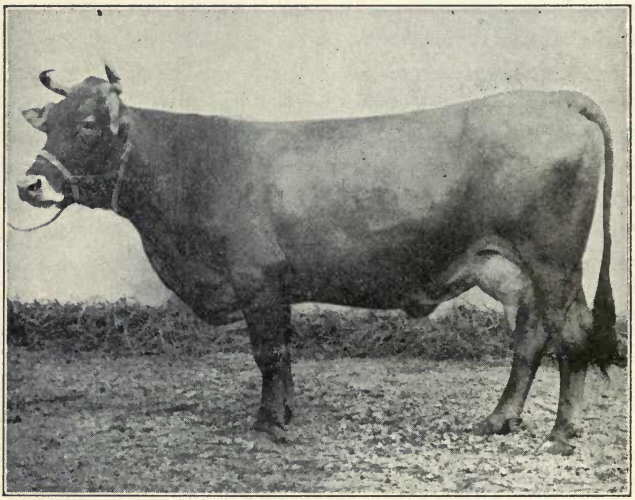
A GOOD TYPE OF THE JERSEY BREED

ties.—The principal dairy breeds have already been described, but a discussion of this question would not be complete without a brief mention of some of the less prominent yet very useful breeds of animals. As the subjects in this book are being discussed principally from a business standpoint, the writer wishes to state that some dairymen will no doubt

be able to reap quite as much profit from some of the following breeds, under certain conditions, as from the breeds which are more strictly of the dairy type.

Brown Swiss.—This dairy breed *par excellence* in Switzerland, and having a fine reputation throughout Europe, has not, however, much prominence in this country. The animals are strong, muscular and active and well adapted to the mountains of Switzerland, many of which are covered to their tops with fine rich herbage. The cattle graze in the valleys in winter and on the mountains in summer. This breed may be placed in the second class as to size, among the distinctly dairy breeds. The color shades from dark to light chestnut brown, and often approaches a mouse color. They are strong, fleshy, compact, well proportioned, hardy and necessarily good mountain climbers. They have a straight back, heavy legs and neck, giving a general appearance of coarseness, although in fact they are small boned, have a fine silky coat and other attractive dairy points. The calves are large, often weighing over 100 pounds at birth. They mature fast and have healthy constitutions. Both bulls and cows are docile and easily managed. If any breed has a claim to the class of so-called "general purpose" animals the Brown Swiss probably approaches it the nearest. Being developed originally as a dairy breed, Brown Swiss cows yield a generous flow of milk and hold out well. Good specimens average 6,000 pounds of milk a year, and in single instances have reached 10,000. The milk tests from 3.5 to 4.0

fat. At the Chicago Show in 1891, one cow of this breed made an average daily record for three days of 81.7 pounds of milk containing 3.11 pounds of fat, equivalent to more than 3½ pounds of butter in one day. These cattle also make good beef. They are



A TYPICAL BROWN SWISS COW

almost always full fleshed and readily fattened when not in milk. The meat is said to be of fine quality.

Devon.—The native home of this thrifty and attractive breed of deep red cattle is on the highlands of Devonshire in southwestern England. The Devonshires are regarded as one of the oldest and purest breeds, and it is believed that they were among the very first cattle brought across the Atlantic, reaching New England in the year 1623.

Among the characteristics of the Devon are attractive appearance, compactness, hardiness, activity, intelligence, docility, and tendency to fatten. The prevailing red varies from a dark rich color to pale chestnut. The hair is soft, fine and often curls closely on the neck, shoulder and face. As a result of centuries of careful breeding the Devon has been brought to a fixed type and is not subject to great variations. They are of medium size, easy keepers, active, hardy, thriving on meager pasture and in hilly and mountainous regions. As a breed Devons do not yield large quantities of milk and are not persistent milkers. Certain families bred for dairy purposes have made fair milk records, and some herds average 4,000 pounds per year. Single animals have produced 50 pounds of milk in a day. The milk is fairly rich in quality, ranking next to the Channel Island breeds in percentage of fat, total solids and high color. Comparatively little attention has been given to their milking qualities, as they are regarded by the majority of breeders as more particularly a beef producer. The beef is highly prized, bringing the top price. The steers are special favorites as working cattle. The calves are always fat and lusty, showing a vigorous growth. The best friends of this breed claim there are great possibilities in developing the dairy qualities of these animals.

Dutch belted.—During the seventeenth century, when the cattle interests of Holland were in the most thrifty condition and breeding had become a science, a breed was developed known in that

country as "Lakenfeld" cattle, but called Dutch Belted in this country. Wonderful and remarkable as it may appear, the Dutch Belted cattle were bred true to color, a pure black with a continuous white belt around their body, beginning behind the shoulders and extending nearly to the hips. This sharp contrast of color makes an imposing contrast and a beautiful sight when several of these animals are seen grazing together. Feats in breeding by the Hollanders, particularly for contrasts in color, were accomplished that would defy our modern breeders, and they have been classed as lost arts. For several centuries they were owned and controlled by the nobility, keeping them pure and limiting their number to their ownership. Importations were first made about the middle of the present century. Their form approaches the dairy type and they possess many of the qualifications of an ideal dairy animal. They are docile, hardy and vigorous and have a very compact form. As milk producers the belted cattle seem to give good satisfaction, though the milk is not above the average in quality. Leading breeders claim for them that they are thrifty, practicable and profitable. One herd of 37 is reported as averaging 5,840 pounds of milk containing 3.6 per cent. fat. Single cows have exceeded 8,000 pounds of milk in a year. This breed is not numerous, either in Europe or America.

Shorthorns as dairy cows.—This breed has made a great influence upon the live stock of England and was the first pure breed to make an impress upon the cattle of the United States, and importations

date back as far as 1783. The climax of the Shorthorn "boom" came in 1873, when 109 head were sold at auction in three hours for $380,000. One cow at this time sold for $40,600.

The aim of most breeders of Shorthorns has been to secure early maturity, size, form and beef producing qualities. "All is useless that is not beef" is the motto generally followed. The Shorthorn is a beef breed and has been so for many generations, but there have always been good dairy cows among them, and in England especially strains and families have been kept somewhat distinct and known as milking Shorthorns. A few breeders in the United States have followed this example and enough were found in 1893 to make up a herd which entered the famous dairy-cow test at the Columbian Exposition, and there made a most creditable record. Although they can hardly claim to belong to the class of special dairy breeds, they are entitled to recognition in these pages. In point of size the Shorthorns are probably the largest among pure breeds of cattle. The weight of the cows ranges from 1,200 to 1,600 pounds and the bulls from 2,000 to 3,000. The colors of the breed have always been various blendings of red and white. In the best milking types the cows are rough and angular in outline, with large, hairy udders and good-sized, straight teats well placed. The animals are quiet and kind in disposition.

The Shorthorns when first brought to America received the name of "the milk breed," and even now the breed has inherent dairy qualities which careful

breeders successfully develop. Among the early records 6 to 9 gallons of milk a day was not uncommon. At the Columbian Exposition the best Shorthorn cow gave 65 pounds of milk in one day and 1,593 pounds in 30 days, yielding 62½ pounds of butter. The best dairy herds of this breed average 6,000 to 7,000 pounds of milk per cow annually and 300 pounds of butter. Single cows have exceeded 10,000 pounds of milk and 400 pounds of butter in

GOOD TYPE OF DAIRY SHORTHORNS

one year. The milk of this breed is of fair quality, averaging about 3.75 per cent. fat. The fat globules are of medium and uniform size, so that cream separates quite readily. The milk is rather pale in color.

Polled Durham.—This is simply a branch or family of the Shorthorn breed, but from the fact that

they have become so fixed in type and in the potency of the hornless feature, they have been allowed a name and place as a distinct breed. Animals registered as Polled Durhams, however, are also admitted to the American Shorthorn Herd Book. This family has all the features of the Shorthorn breed except that they are hornless; this feature being developed through sports and selection. It may be said that this is the only breed of cattle originating in America. Its foundation, however, goes back to England. While they are classed as beef animals, the milking qualities have not been lost sight of and among them are some excellent milkers. As they practically duplicate the "Shorthorns" in dairy capacity, a separate description is unnecessary.

Red Poll.—Hornless or polled cattle have existed in different counties in England from time immemorial. The modern Red Polled cow in this country is the result of the combination of several strains of polled cattle, and it is the aim of the most progressive breeders to produce a cow of medium size, blood-red in color, of fine bone, compact form, fattening easily and giving a fair flow of moderately rich milk. In other words, the "general purpose" cow idea is kept in mind. The breed is comparatively new. Red Polled cattle resemble the Devons almost as closely as Polled Durhams resemble the Shorthorns, yet the two races are probably not closely related. The Red Polls, however, are somewhat larger, and the cows as a rule are better milkers than the Devons. Their meat is fine grained and of high quality. As dairy animals this breed

must be placed in the second class with the other breeds which aim to serve the dual purpose. Being comparatively few in number in this country there are not many dairy records at hand. Records of herds averaging 6,000 to 7,000 pounds of milk are reported, and single cows have produced 12,000 pounds. The milk is of fair quality, averaging about 3.75 per cent. fat. It should be remembered that the above records are from select herds and are far above the average for the breed.

BREED TESTS

Comparative yields of milk and butter fat.—The following statements, taken from the Report of the Wisconsin Experiment Station for 1903, show the average per cent. of fat and production of milk and

Average Per Cent. of Fat and Production of Milk and Butter Fat per Breed—American and European Analyses (Woll)

Breed	Fat Tests		Records of Yield		
	Number of Cows	Fat in Milk	Number of Cows	Average Daily Milk Yield	Average Daily Fat Yield
		Per cent.		Lbs.	Lbs.
Jersey	491	4.98	425	27.3	1.36
Guernsey	191	4.77	151	29.7	1.42
Holstein-Friesian	679	3.28	503	48.8	1.60
Shorthorn	370	3.73	275	43.5	1.62
Ayrshire	108	3.84	50	37.0	1.42
Red Polled	50	3.73	50	37.3	1.39
Brown Swiss	20	3.78	14	37.3	1.41
Devon	50	4.57	27	13.2	.60
Dutch Belted	5	3.40	5	27.2	.92
Polled Jersey	5	4.66	5	22.3	1.07
French Canadian	5	3.99	5	27.0	1.08

butter fat per breed. The data for per cent. of butter fat in the table which follows includes tests of the milk of 1,974 cows and the data for milk yield includes tests of 1,510 cows.

This summary includes a large number of European analyses of milk, especially of milk from Shorthorn, Jersey, and Holstein cows, and it may therefore be argued that the results do not fairly represent the quality and yield of milk produced by American cows of the respective breeds. To overcome this criticism all available analyses of milk produced by purebred American dairy cows were compiled and the results of this second summarization are shown in the following table, which includes data for 881 cows as regards the fat content of the milk and for the average milk yield of 825 cows:

Summary of American Analyses of Samples of Milk from Purebred Cows (Woll)

Breed	Fat Test		Records of Yield		
	Number of Cows	Fat in Milk	Number of Cows	Average Daily Milk Yield	Average Daily Fat Yield
		Per cent.		Lbs.	Lbs.
Jersey	164	5.13	153	24.5	1.26
Guernsey	67	4.87	53	28.9	1.41
Holstein-Friesian	502	3.30	493	48.9	1.61
Shorthorn	43	3.58	39	31.9	1.14
Ayrshire	33	3.85	18	27.7	1.07
Red Polled	15	3.84	15	26.6	1.02
Brown Swiss	14	3.77	14	37.3	1.41
Dutch Belted	5	3.40	5	27.2	.92
Devon	28	4.64	25	11.8	.55
Polled Jersey	5	4.66	5	22.9	1.07
French Canadian	5	3.99	5	27.0	1.08

If the results are arranged in the order of the aver-

age daily amounts of fat produced by the cows, we note that the Holstein-Friesian cows lead the list with an average production of 1.61 pounds of fat. The other breeds follow in this order: Guernsey and Brown Swiss, 1.41 pounds of butter fat; Jersey, 1.26 pounds; Shorthorn, 1.14 pounds; French Canadian, 1.08 pounds; Ayrshire and Polled Jersey, 1.07 pounds; Red Polled, 1.02 pounds, etc.

The data obtained for the Holstein-Friesian cows differs somewhat in their character from those for cows of the other breeds from the fact that the Holstein tests in a large majority of cases were of short duration, i.e., mostly seven days, and were conducted under a more or less forced system of feeding. The large number of animals contributing to the average data for this breed renders the figures valuable as an expression of the average quality of milk of American Holsteins and their production of milk and butter fat at this time. The latter figures may be considered maximum when the performance of a large number of animals is summarized. The data given in the column headed "Per cent. of fat" represent, as we believe, very accurately the average quality of milk produced by purebred cows of the different dairy breeds in this country at the present time.

CHAPTER II

MILK RECORDS

Value of milk records.—Records of the performances of dairy cows form the only accurate and safe basis for judging their value. No person is able to go into a good-sized herd and pick out all of the best cows by examination. Records are absolutely necessary to determine profit and loss. In one community, where the dairymen had the same soil and the same market, it was shown that one made $2.50 for every dollar invested in feed, while his neighbor lost 50 cents. This difference was due almost entirely to a lack of business methods. It is the constant aim of progressive dairymen to improve their herds, and such improvement must depend largely upon culling the herd and getting rid of the unprofitable animals. From the breeder's standpoint, records are especially valuable in assisting in finding customers for their stock. Many buyers insist upon seeing records of performance before purchasing.

A record is also of great help to the feeder. If he knows exactly what a cow is doing he can prepare the ration accordingly and often feed more economically. Again, a daily milk record enables a dairyman to detect the approach of sickness in a cow and thus to take steps to ward it off.

Much inspiration is obtained from keeping a record, and nothing gives a dairyman more satisfaction than watching the improved returns from his herd. Many of the State experiment stations have

given examples of the importance of keeping careful records of the individual cows, and thus determining which are profitable and which are kept at a loss.

EXAMPLE 1.—At the Georgia station the best cow in the herd gave 7,968 pounds of milk, which produced butter worth $115.44, while the poorest cow in the same herd gave only 2,788 pounds of milk, with a butter value of $41.63.

EXAMPLE 2.—At the Michigan station the profit on the milk from different cows varied from $6.08 to $94.05.

EXAMPLE 3.—At the New Jersey station the profits from different cows varied from 13 cents to $49.72 when milk was valued at $1 per 100 pounds.

EXAMPLE 4.—At the Connecticut (Storrs) station, during the year 1903, the best cow gave a profit of $54.72, and the poorest $2.76. In this case the best cow gave a profit of nearly twice that of the average cow in the herd.

EXAMPLE 5.—At the World's Columbian Exposition, Chicago, the cow with the best individual record made two and one-third times as much butter as the poorest of the seventy-five.

While the difference between the best and poorest animals in the examples given are great, the poorest cows reported are not so poor as many of those kept by individual dairymen, who make no accurate tests and who rarely know anything of what each animal is actually doing. Strong evidence is given on this point by the Illinois Experiment Station, which found, after testing a number of herds in the State, that nearly every one proved that some of the cows

produced butter enough to pay a handsome profit to the owner, while others that required the same feed, care and time spent in milking, did not make butter enough to pay for the food they ate. One man who kept twelve cows got more money for the milk of three of them than he did for that of all the other nine put together.

To cite an example of a single dairyman in a Western State, eleven heifers in his herd gave, during the first milking season, 2,807 pounds of butter, which netted 20.4 cents per pound, an average of $51 for each heifer. With an allowance of $40 for feed, he had a net average profit of $11 per head. In the absence of a daily record he might have been content with the result and gone on in blissful ignorance of the fact that five of the heifers, instead of giving a profit of $11 each, actually lost for him an average of $8.20 each. Neither would he have known that six of the heifers gave him an average profit of $27. Further, he would not have known that if he had not been the unprofitable owner of the five poorest heifers, his whole profit, instead of being $121, would have been $162, or $41 more profit with no more than half the work. The last statement is the most important, for many dairymen could reduce their herd one-half (and the labor and capital as well) and still be making more profit. This is the great lesson which the dairy farmer needs to learn to-day, for it is the foundation of profit in dairy farming.

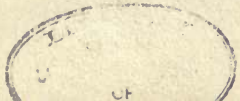
Accurate records necessary.—Guesswork is expensive to the dairyman. Even the best judges are

not able to pick out the best cow in a herd without weighing and testing. Farmers know the good and poor milkers in their herds in a general way, but only a few breeders, whether of common or pure-bred stock, use the scales or fat test to supply definite knowledge. When the milk is not weighed the amount is almost sure to be overestimated. The fact that a cow gives 12 to 15 quarts of milk a day at a certain time does not prove that she will give 5,000 pounds in a year. She must be fed and cared for during the entire twelve months, and the profit or loss depends upon what she will produce during the entire year. Even dairymen who have bred and handled their own cows are not able to estimate their yearly yield of milk, and those who have attempted it have usually come wide of the mark. In one instance reported, a dairyman before beginning his test made a note of the joint opinion of himself and his sons who had done the milking in the herd for years, as to the half dozen best cows in the herd, and an estimate of their season's milk yield. When the year's record was completed it was found that, in order of actual merit, the cows stood thus: First the fifth; second a cow not on his merit list; third his fourth; fourth his first; fifth his sixth; sixth like the second, and his second and third still lower on the list. These facts were verified by subsequent records. The records showed this owner further that about one-fourth of his cows were being kept at a loss, while others barely paid their way.

The record of the herd is a matter of the utmost

importance. The highest degree of success cannot be attained unless dairymen know accurately the production of each individual cow. This is necessary as a guide to rational treatment and to insure the greatest profit. The record should include not only the dairy performance, but a concise history and description of each animal. The former requires a daily record of the milk yield of every cow and a fat test of several consecutive milkings, if accurate records are to be secured. Samples for this test may be mixed and this "composite sample" tested, thus obtaining the average. The method is easily learned and practiced. With the percentage of fat taken periodically and a summary of the daily yield of milk, the dairyman has a full record of every cow in his herd. To give still more complete knowledge there should also be a record, at least approximately accurate, showing the cost of the food consumed by each cow, so that the economy of the production may be shown.

Records easily kept.—Records are far more easily kept than are generally supposed, and the time and cost of keeping them for each cow is so small as to be only a trifle in comparison with their value. The length of time required to weigh and sample the milk will depend much upon the quickness of the individual doing the work. Ordinarily, however, it has been the author's experience that one-fourth minute per cow at each milking, or one-half minute per day, is sufficient to record the weights. When samples are taken on two successive days in each month, which is becoming a common practice, this



FORM FOR DAILY MILK RECORD.

NAME OF COW	PRINCESSA		REGENA 4th.		Q. BEAUTY		Q. IDEAL		QUEEN		ALTA		SEBOLT		E. JILIX		EVESTA 6th.	
MONTH	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M	P.M.	A.M.	P.M.
	lbs.	lbs.	lbs.	lbs	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
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will require practically the same time daily per cow as weighing the milk. An hour or two some rainy day is all that is necessary to make the Babcock test for percentage of fat. With this amount of time expended the farmer can have a reasonably accurate

KEEPING A CAREFUL RECORD OF THE WEIGHT OF MILK

dairy record of every cow in his herd. Considering the time consumed in doing this work, and the small expense involved in securing record sheets, scales, and some simple form of the Babcock tester, it is surprising that more dairymen do not test their herds. After keeping records the farmer will find that he has made many surprising mistakes in his estimates of the relative value of his cows.

The Babcock test.—While full directions usually accompany the apparatus as purchased it will not be out of place to state briefly here the principles of

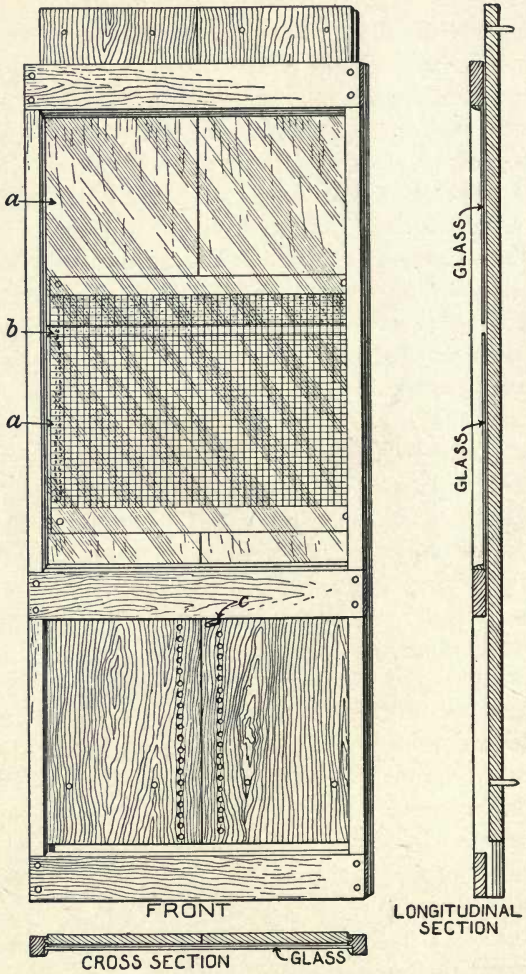
the test and how it is operated. The outfit consists of a pipette for measuring the milk sample, an acid measure, test bottles graduated to 10 per cent., and a centrifugal machine for whirling the bottles and contents at high speed. Small machines are easily operated by hand, while large ones require power.

The important thing at the outset is to secure a fair sample of the milk to be tested. This is accomplished by thoroughly mixing the milk by repeatedly pouring it from one vessel to another. It is then in condition to sample. The sampling may be done by using a small dipper. Owing to variations in the composition of the milk from day to day and in the morning's and evening's milk of the same day, it is necessary to collect several samples if accurate results are to be secured. These may be brought together for two or three days and made into a composite sample before the test is made. A few drops of formalin or a little potassium bichromate may be used to keep the sample sweet. The composite sample thus obtained should be thoroughly mixed. The pipette is then drawn nearly full of milk by placing the mouth at the end; the forefinger is then quickly placed over the top end of the pipette as it is removed from the mouth; the pipette is held on a level with the eye, while the milk is allowed to run out slowly until its surface is even with the 17.6 mark. The pipette is then inserted far enough into the test tube to allow the milk to run in without spilling. After the pipette has drained, the last drop is blown from it and the sample is ready for the acid.

The ordinary commercial sulphuric acid, having a

specific gravity of about 1.82, is used in making the test. It should be used at a temperature ranging from 50° to 70° F. and always kept in a tightly stoppered bottle. Care must be taken in mixing the acid with the milk; 17.5 c. c. are measured into the acid graduate and slowly turned into the test tube in such a way that it runs down on the inside of the bottle rather than directly into the milk, to prevent burning the milk solids. A complete mixture is effected by holding the bottle by the neck and giving it a gentle rotary motion. The action of the acid causes a rapid increase in temperature, at the same time dissolving all the non-fatty solids of the milk and making possible a rapid and complete separation of the fats.

The test bottles and contents are now placed in the centrifugal machine and whirled at the required speed, which varies with the size of the machine. The bottles assume a horizontal position, and as the fats are the lighter part of the milk they rise to the surface. With the hand machine full speed should be maintained for five or six minutes for the first whirling, after which enough hot water should be added to the contents of the bottles to float the fat within the limits of the graduated scale on the neck of the test bottle. The bottles are whirled again for two or three minutes at full speed, after which they should be placed in hot water (temperature 125° to 140° F.) to keep the fat in a clear liquid state for reading. If when managed in this way clots of curd or other matter are mingled with the fat, making the reading uncertain, the difficulty can usually be



ADJUSTABLE RECORD BOARD DESIGNED BY THE AUTHOR

avoided by adding the hot water in two portions, filling the bottles at first only to the neck, and after whirling about one minute adding sufficient hot water to bring the fat into the graduated neck, after which the bottle should be whirled and the fat measured.

If a steam-power machine is used it will not be necessary to place the bottles in hot water.

The percentage of fat is determined by the graduated scale on the test tube. A pair of dividers or small compasses (Fig. 4) can be used to good advantage in reading the results. The two points are carefully adjusted, so they exactly enclose the fat column. The lower point is then placed at the zero mark; the other point will then indicate the exact reading.

The result obtained gives the percentage of butter fat in the milk. To determine how many pounds of butter a cow is producing, multiply the pounds of milk produced by the percentage of butter fat, and multiply the result by 1 1/6.

EXAMPLE: 24 (pounds milk) $\times$ 0.04 (per cent. fat) $=$0.96. (pound fat) $\times$ 1 1/6 $=$ 1.12 (pounds butter).

Record board.—The accompanying cut (page 88) represents a record board designed by the author at the New Jersey Experiment Station. A record sheet of sufficient size to include the weight of the morning and evening milk of each cow in the herd for a month is attached to this board by means of thumb tacks. Two panes of glass (*a-a*) are set in the frame in front of the record sheet with a space (*b*) of three-fourths of an inch between them for entering

the record. The record board is so constructed that the front frame can be lowered each day to enter the new record by adjusting the pin (*c*) which holds it in place. It has the advantage of keeping the record sheet clean and in condition for permanent filing. The glass can be readily cleaned with a moist sponge.

Methods of estimating records.—Several methods of estimating yearly records from a few weighings and tests have been proposed. As previously stated, however, the only absolutely accurate way to tell the amount of milk and butter fat produced by a cow is to weigh and test the milk at every milking. Cows vary so much in the amount and quality of their milk from one milking to another, owing to various causes, many of which are uncontrollable, that entirely accurate results cannot be secured by weighing and testing the milk secured at a few milkings and using the results as a basis for estimating the total production for a lactation period, or even for a month. Many dairymen, however, do not feel that they can take the time to secure daily records; nor is this necessary if it is simply desired to obtain a reasonably accurate estimate of a cow's performance at the end of the year. An approximate record is sufficient for comparing one cow with another or for determining whether a cow is up to the profit standard.

CHAPTER III

THE YIELD OF MILK

Raising the standard.—It is interesting to note that the average production of milk and butter per cow in the United States has been increasing slowly yet constantly from one decade to another. The following data shows the census returns from 1850 to 1900:

Average Production per Cow in the United States

YEAR	Milk	Butter	YEAR	Milk	Butter
	Lbs.	Lbs.		Lbs.	Lbs.
1850.....	1,436	61	1880.....	2,004	85
1860.....	1,505	64	1890.....	2,709	115
1870.....	1,772	75	1900.....	3,646	155

While this increase is encouraging, even the record for the year 1900 is too low to afford the dairyman much profit at the average price for milk and butter. The record indicates further that many dairymen whose herds are below the average in production must be keeping cows at a loss. As a matter of business, then, and a condition essential to best results, every dairyman should study the individuality of his cows, set a standard, and maintain it by promptly disposing of the animals which fail to attain it, unless he has reason to believe that an animal will make a better record in the future. When the standard is reached it should be gradually but persistently raised. This can be done by

keeping a record of the quantity and quality of the milk product, knowing approximately the cost of production and systematically weeding out the herd. Many dairymen are doing this, and the following examples will serve as illustrations:

EXAMPLE 1.—The Babcock test was introduced in a creamery and one dairyman started to test his cows and found many surprises. The butter made per cow ranged from 137 to 502 pounds, and the average of the whole herd was 271 pounds. Out of the 64 cows 21 failed to come up to his standard of 200 pounds annually and were sold to the butcher. The second year the standard was put at 210 pounds and 15 cows were disposed of. The third year the standard was put at 225 pounds and he had but 6 to sell. The fourth year his mature cows reached 300 pounds of butter. He made the remark that many dairies were doing better than his and that there was no reason why any dairyman could not do as well. The business requires time and perseverance the same as any other.

EXAMPLE 2.—A dairyman having 17 native and grade Shorthorn cows found the average annual yield of butter for the herd to be 125 pounds per cow. This did not pay. The Babcock test was then applied and in four years (1886) the average was raised to 151 pounds and the cash returns were a trifle over $36. In 1894 15 cows averaged 220 pounds of butter and $46.65 per head. In 1895 the herd made an average of 234½ pounds of butter worth $47.84. During 1896 the herd averaged 301 pounds of butter and $52.30 per head. And in 1897

the herd averaged 5,691 pounds of milk and 343 pounds of butter. The butter sales averaged $60.28 per cow. Dairy records aid in selection and increase the profits.

EXAMPLE 3.—The owner of a Holstein-Friesian herd weighs the milk daily in bulk and determines the fat in each cow's milk monthly; the individual milkings of each cow being weighed for the first three days of each month, a composite sample taken and the per cent. of fat determined by the Babcock test. The average yield of milk for the herd for a term of years was 10,500 pounds per cow, inclusive of all heifers. The yield would have been larger but for the fact that the herd was kept young by selling the older cows. The average yearly per cent. of fat for the herd was 3.45, and the yield of butter was equivalent to 422 pounds. It has long been the aim of this dairyman to have his herd average 400 pounds of butter fat per year, but after passing the 350-pound mark it has been found more difficult to increase the yield. However, he expects to reach it in time.

High records can be reached only by years of persistent effort and accurate testing.

CHAPTER IV

RECORDS OF PUREBRED COWS OF SPECIAL IMPORTANCE

THE keeping of accurate records is perhaps of more importance to the owner and breeder of purebred stock than to dairymen who have nothing but grade and native cows in their herds. With the breeder of purebred stock the products of the dairy are often a secondary matter, his principal business being to breed and sell the animals. If he can present creditable records of the cows and heifers he may have for sale as well as those of their ancestors for some years before, naturally these will assist in advertising his stock. It has been the aim in the following pages to present records of purebred herds of various breeds kept under a variety of conditions of soil and climate, and it is hoped that these will be of some value not only to the dairyman but to the breeder as well. The data given in connection with the one hundred or more herds are quite full and should give some light to those seeking dairy knowledge. They represent every-day working herds, give the kinds of feeds employed and the cost of same, and show what results may be expected where good rations are fed and business methods practiced generally.

TABLE ——, MILK AND BUTTER RECORDS OF PUREBRED HERDS FOR ONE YEAR

No. of Cows	Average Age	Breed	Breed of Bull	Cows Raised	Cows Purchased	When Fresh	Summer Rations	Winter Rations	Cost of Keeping Cow	Av'ge Annual Production		Average Fat in Milk
										Milk	Butter	
										Lbs.	Lbs.	P. ct.
25	6	Ayrshire.....	Ayrshire.	Yes.	.....	All times.	Pasture; green oats; grain.	Grain, 7 to 10 quarts (cotton-seed meal 1/5, bran 2/5, middlings 1/5, oats and corn 1/5).	$60 00	6,500	280	3.8
35	4	do	do ...	Yes.	Few.	do	Pasture	Silage; alfalfa; hay; gluten feed, bran, oil meal.	47.00	.....	.....	4.2
15	4½	do	do	Yes.	.....	Spring and fall.	Pasture; oats and peas; corn fodder; green hay.	Silage; clover; mixed hay; oat and pea hay; grain, 6 to 8 pounds (cotton-seed meal, corn and cob, gluten).	35 00	6,480	300	.....
18	7	do	do	Yes.	.....	All times.	Pasture; gluten, linseed meal, bran, and middlings.	Silage; hay; grain similar to summer.	70 00	7,100	301	3.6
22	8	do	do	Yes.	Bulls	do	Pasture	Silage, 1 bushel; grain, 6 quarts (bran 3/4, cotton-seed meal 1/4).	40 00	6,000	300	.....
75	5	do	do	Yes.	.....	do	Pasture; sometimes hay and grain.	Silage, 1 bushel; hay; grain.	.....	.....	.....	3.0
13	4	do	do	Yes.	.....	Spring ...	Pasture	Corn meal, barley meal, and mixed feed.	35 00	.....	.....	3.9
20	7	do	do	Yes.	.....	All times.	Pasture; gluten.....	Silage; hay; gluten and middlings.	.....	.....	.....	.....
32	7	do	do	Yes.	.....	Fall and spring.	Pasture; grain (1/3 cotton-seed meal, 1/3 bran, 1/3 corn and cob meal).	Corn stover; corn; pea and clover hay; grain.	50 00	5,545	243	3.76
40	5	do	do	Yes.	.....	Fall and winter.	Pasture; corn silage, or 4 quarts bran.	Silage, 1 bushel; hay; 3 quarts gluten and 3 quarts bran.	35 00	7,000	300	.....
25	4	do	do	Yes.	.....	Fall	Pasture; 6 pounds grain.	Silage and hay; 12 pounds mixed grain.	40 00	7,000	.....	4.9
15	4½	do	do	Yes.	.....	Spring ...	Pasture	.....	30.60	.....	250	4.25

No. of Cows	Average Age	Breed	Breed of Bull	Cows Raised	Cows Purchased	When Fresh	Summer Rations	Winter Rations	Cost of Keeping Cow	Av'ge Annual Production		Average Fat in Milk
										Milk	Butter	
										Lbs.	Lbs.	P. ct.
30	6	Ayrshire.....	Ayrshire.	Yes.	.....	All times.	Pasture; light feed of grain to heavy milkers.	Hay; millet; grain; vegetables.	40.00	6,000	300	4.25
15	7	do	do	Yes.	.....	do	Pasture (clover and timothy).	Silage; corn fodder; malt sprouts, gluten, bran.	43 00	7,377	347	4.2
30	5	do	do	Yes.	.....	do	Pasture; 4 quarts bran.	Silage, ½ bushel; hay; 1 to 8 quarts bran and 1 quart barley.	50 00	7,183	320	3.82
...	6½	do	do	Yes.	Bulls	do	Pasture; fresh brewers' grains; cotton-seed meal; hay.	Ensilage; fresh brewers' grains; cotton-seed meal; hay.	30 00	6,000	250	3.7
10	5	Brown Swiss.	Brown Swiss	Yes.	.....	do	Pasture; in dry time corn meal, bran, and oil meal.	Silage; cob meal, bran, oil meal, and gluten feed.	.....	6,681	.....	.....
10	8	Devon	Devon....	Yes.	.....	Spring ...	Pasture; supplemented by bran, corn, and oats.	Hay; corn fodder; corn and oats; bran.	26 00	5,100	250	4.3
9	5	North Devon.	North Devon.	.....	Yes..	Fall	Pasture; alfalfa hay..	Alfalfa hay; carrots.....	16 00	*1,849	.....	.....
37	5	Dutch Belted	Dutch Belted.	Yes.	.....	All times.	Pasture	Hay; shredded corn fodder; corn and cob meal, bran.	32 00	5,840	.....	3.6
18	...	Guernsey.....	Guernsey	Yes.	.....	do	Pasture; soiling crops; some grain.	Silage; hay; grain.....	59 00	4,598	.....	5.54
35	5	do	do	Yes.	Few.	do	Pasture; after Aug. 1, gluten.	Mixed hay; clover; corn fodder; chop and oil meal.	40 00	7,000	375	5.0+
15	5	do	do	.....	.....	Fall	Pasture; bran, gluten feed.	Silage; bran and gluten.	.....	7,000	350	.....
25	6	do	do	Yes.	Bulls	do	Pasture; corn fodder; corn silage.	Clover hay; corn fodder; bran; gluten meal.	30 00	8,000–10,000	.....	5.0
25	6	do	do	Yes	.....	All times.	Pasture; grain; silage when pasture is short.	Silage; clover hay; grain (¼ corn, ¼ oats, ¼ brewers' grains, ¼ malt sprouts).	35 00	6,400	370	5.0

*Average of 5 cows for four months (not counted in general average).

20	6	Guernsey.....	Guernsey..	Yes.	Yes ..	All times.	Pasture; green corn; grain (bran ¾, corn meal ¼).	Silage; hay; corn fodder (bran, corn meal, gluten meal, and oil-cake meal).	50 00	7,000	390	5.0
18	6	do	do	Yes.	.....	.....	Pasture; oats and peas; clover; corn meal and cotton-seed meal.	Silage; hay; bran, corn meal, and cotton-seed meal.	.....	4,610	275	5.0
19	5	do	do	.....	.....	Fall, winter, and spring.	Pasture; bran; silage; sorghum when pasture is short.	Corn and soy bean silage; hay (clover and alfalfa); 10 pounds grain.	40 00 45 00	6,000	325	5.0
14	6	do	do	Yes.	.....	Spring ...	Pasture; green corn; green oats; feed twice a day.	Clover hay; corn and stalk ground; oats and corn.	24 75	.....	300	4.0
45	4½	Holstein	Holstein.	Yes.	Few.	Winter ...	Pasture; sugar cane; alfalfa; ground oats and middlings.	Silage; clover; alfalfa hay; ground corn with cob, oats, bran, middlings, gluten, linseed meal.	45 00 50 00	6,000– 10,000	225 375	....
30	5	do	do	Yes.	.....	All times.	Pasture; union grains, gluten, and bran.	Union grains, corn meal, and bran.	.....	8,000	.....	.....
30	...	do	do	Yes.	.....	do	Pasture; bran; silage..	Silage; bran, gluten feed, corn, oats, barley; hay.	.....	8,500	335	3.4
45	7	do	do	Yes.	.....	do	Pasture; grain ration (mixed feed).	Silage with corn on it; hay; mixed feed.	35 00	7,600	.....	.....
60	6	do	do	Yes.	Yes..	do	Pasture; corn meal and bran.	Corn meal and bran....	50 00 75 00	10,000– 12,000	.....	3.9
40	4	do	do	Yes.	.....	Spring ...	Pasture; 1 quart bean meal.	Silage; hay; 4 quarts pea meal.	35 00	.....	275	3.8
22	6	do	do	Yes.	Yes..	Spring and fall.	Pasture; 2 quarts bran.	Four quarts (bran, oats, and corn meal, equal parts).	30 00	8,000	.....	3.5 3.8
31	3	do	do	Yes.	.....	All times.	Pasture; brewers' grains; silage.	Silage; clover hay; fodder; brewery grains; bran and gluten.	30 00	.....	430	3.5
25	5	do	do	Yes.	.....	do	Pasture	Clover; corn stover; corn, oats, and bran.	30 00 35 00	8,500– 9,000	.....	3.6
70	5	do	do	Yes.	Yes..	Spring and fall.	Pasture; clover hay; bran, oil meal, hominy meal, dried grains.	.....	.....	10,000	375	.....
16	5	do	do	Yes.	.....	do	Pasture; union grains.	Hay; shredded corn stalks; union grains; corn and cob meal.	50 00	10,000	450	4.0

No. of Cows	Average Age	Breed	Breed of Bull	Cows Raised	Cows Purchased	When Fresh	Summer Rations	Winter Rations	Cost of Keeping Cow	Av'ge Annual Production		Average Fat in Milk
										Milk	Butter	
										Lbs.	Lbs.	P. ct.
35	4	Holstein	Holstein.	Yes.	.....	Spring and fall.	Pasture, supplemented by grain (ground oats ⅓, bran ⅓, corn meal ⅓).	Ground oats, corn meal, bran, oil meal, 12 to 18 pounds.	35 00	14,000	.....	3.7
30	4	do	do	Yes.	.....	All times.	Pasture; bran, gluten feed; silage in fall.	Silage; hay: corn stover; bran, corn and oat chop, and gluten feed.	30 00	10,000	.....	3.8
35	5	do	do	Yes.	.....	do	Pasture; silage; bran when pasture is short.	Silage; hay; bran, oil meal, ground barley.	.....	4,500	200	.....
15	5	do	do	Yes.	.....	Fall	Pasture; oats and corn in late fall.	Silage; hay; corn stover; oats, corn, bran.	30.00	.....	350	3.6
90	5	do	do	Yes.	Few.	Fall, winter.	Pasture; silage, bran, "XXXX."	Silage; hay; bran, "XXXX," malt sprouts, corn, oats, barley.	55 00	9,850	.....	.....
28	6	do	do	Yes.	Few.	do	Pasture; green fodder.	Silage, 40 pounds; clover hay, 10 pounds; mangels, 12 pounds; grain, 8 pounds (bran 3-7, barley meal 2-7, gluten 2-7).	51 00	7,500	328	.....
110	...	do	do	Yes.	Few.	All times.	Pasture; bran, gluten; silage.	Bran, gluten, oats and corn, and oil meal.	60 00	7,000–12,000	.....	3.7
150	...	do	do	Yes.	.....	Winter ...	Pasture; 4 pounds grain.	Grain, 4 to 14 pounds, according to milk flow.	45 00 50 00	8,000–12,000	.....	.....
25	5	do	do	Yes.	.....	Fall, winter.	Pasture; wet brewers' grains; corn meal.	Silage, 40 pounds; brewers' wet grains, 8 pounds; hay, 10 pounds; grain, 10 to 15 pounds (bran 300, gluten 125, corn meal, 100).	50 00	9,304	370	3.4
14	5	do	do	Yes.	Few.	Fall	Pasture; ground oats and bran.	Clover, timothy, and wild hay; corn fodder; bran, ground oats, corn and cob meal.	35 00	8,000	300	3.5

20	4	Holstein.....	Holstein.	Yes.	Few.	Fall, winter.	Pasture; silage; 6 to 10 pounds bran, small oats.	Silage, 30 to 40 pounds; clover hay, 8 to 10 pounds; grain (bran ½, gluten feed ¼, ground oats ¼).	50 00	10,000	400	3.45
14	6	do	do	Yes.	Few.	do	Pasture; 2 quarts grain (bran 600, corn meal 400, cotton-seed meal 100, oil meal 100).	Silage; hay; 6 quarts mixed grain.	72 00	14,000	.....	.....
32	5	do	do	Yes.	.....	Spring and fall.	Pasture; after July 15, gluten, oat and barley meal, "XXXX."	Silage; hay; 8 pounds mixed grain.	40 00	8,326	355	3.66
40	4½	do	do	Yes.	.....	Winter ...	Pasture; silage; hay; bran, ground oats, and corn.	Silage; hay; bran, ground oats, and corn.	.....	7,507	233	.....
30	5	do	do	Yes.	.....	Fall	Pasture	Silage; hay; bran, oat meal, rye, barley meal.	27 00	10,000	430	3.7
20	4½	do	do	Yes.	.....	do	Pasture; silage; grain (bran and corn meal).	Silage; hay; grain (bran, ground oats, gluten feed, equal parts).	40 00 50 00	11,515	.....	3.6
15	6	do	do	Yes.	Few.	do	Alfalfa hay; corn and cob meal; kaffir corn heads; bran, oat meal.	Same as in summer, only more of it.	22 00	10,500	.....	.....
150	7	do	do	Yes.	.....	Fall, winter.	Pasture; green fodder.	Silage; hay; barley sprouts, gluten (nutritive ratio 6:1).	38.00	6,500	.....	.....
23	7	do	do	Yes.	Yes..	do	Pasture; green fodder; rye and bran.	Silage; hay; fodder; bran, gluten, corn and cob, oats, oil meal.	30 00 35 00	6,000– 10,000	.....	3.5 3.8
16	5	do	do	Yes.	.....	do	Pasture; distillers' dried grains; wheat bran.	Silage; hay; corn stover; oat straw; distillers' dried grains, and bran.	50 00	8,000	315	3.7
33	...	do	do	Yes.	.....	.....	Pasture, supplemented with oats and peas and fodder corn; grain ration.	Silage; hay; grain.....	.....	7,664	.....	.....
100	5	do	do	Yes.	.....	All times.	Pasture; silage; gluten feed.	Silage; hay; oat straw; bran, gluten feed, corn meal.	50 00	12,000	500	3.4 4.0
59	...	do	do	Yes.	.....	do	Pasture; hay; gluten feed, corn and oats, bran, corn.	Silage; hay; gluten feed, bran, corn and oats, corn.	50 00	9,768	.....	.....

No. of Cows	Average Age	Breed	Breed of Bull	Cows Raised	Cows Purchased	When Fresh	Summer Rations	Winter Rations	Cost of Keeping Cow	Av'ge Annual Production		Average Fat in Milk
										Milk	Butter	
										Lbs.	Lbs.	P. ct.
150	5	Holstein.....	Holstein.	Yes.	Yes..	Fall, winter.	Pasture	Pasture; mill feed; and beets.	30 00	10,000	430	3.7
36	4	do	do	Yes.	.....	Spring, fall.	Pasture; small amount bran.	Silage; hay; bran, gluten, and distillers' dried grains.	.....	8,128	332	3.5
15	5½	Jersey	Jersey....	Yes.	Few.	Fall, winter.	Silage; alfalfa hay; corn and cob meal and oil meal; no pasture.	Same as summer.....	35 00	6,570	398	5.2
22	7	do	do	Yes.	.....	All times.	Pasture; green oats and peas; bran and gluten during dry period.	Silage; hay; bran, gluten. oil meal, dried-beet pulp, ground oats.	68 00	6,550	405	5.3
24	5	do	do	Yes.	.....	Fall	Pasture	Silage; hay; pea hay; Hungarian grass; oats, bran, and cotton-seed meal.	30 00	5,000	300	5.25
70	6	do	do	Yes.	Half.	All times.	Pasture; cowpeas and green corn; bran and cerealine.	Silage; hay; corn fodder; ground corn and oats, cotton-seed meal, bran.	50 00	5,650	.....	5.5
60	6	do	do	Yes.	Few.	. do	Pasture; alfalfa.....	Alfalfa hay; bran, corn meal. cotton-seed meal, and cotton-seed hulls.	32.50	.....	389	5.0
130	8	do	do	Yes.	Few.	do	Pasture; soiling crops; grain 7 pounds average.	Silage; hay; stover; grain, 7 pounds (corn meal, cotton-seed meal, oil meal. crushed oats, bran, distillers' grains, molasses feed, gluten).	.....	5,365	383	.....
26	...	do	do	Yes.	.....	do	Pasture; soiling crops —clover, corn, alfalfa.	Silage; hay; corn stover; mangels; corn on cob, oats, barley, and oil meal.	48 00	6,325	402	5.45

40	6	Jersey.....	Jersey ...	Yes.	Few.	All times.	Pasture; grain.....	Silage; hay; grain.....	50 00	7,280	467	5.5
21	5	do	do	.....	.....	.....	.....	.....	.....	5,037	289	4.9
20	6	do	do	Yes.	Yes..	All times.	Pasture; bran when pasture is poor.	Clover hay; ground corn and bran.	25 00	.....	400	5.2
25	6	do	do	Yes.	Few.	do	Pasture; hay; green crops; cotton-seed meal and bran.	Silage; hay; potatoes; 4 to 8 quarts of cotton-seed meal and bran.	50 00	4,800–6,000	300 350	5.4
10	6½	do	do	Yes.	Few.	Fall, winter.	Pasture; bran and cotton-seed meal.	Corn stover, 20 pounds; corn and cob meal, 6 pounds; gluten, 3 pounds; cotton-seed meal, 2 pounds; linseed meal, 1 pound.....	35 00	5,548	353	5.45
20	5	do	do	Yes.	Few.	All times.	Pasture; silage; clover; bran, corn and cob meal.	Silage; clover hay; shredded fodder; bran, corn and cob meal.	40 00	5,000	.....	5.0
250	7	do	do	Yes.	.....	do	Pasture to July; then add green corn and grain.	Bran, 7 pounds; chop feed, 4 pounds; cocoanut cake, 1 to 1½ pounds.	45 00	4,800	300	.....
70	6	do	do	Yes.	.....	do	Pasture; silage; dried-beet pulp; cotton-seed meal.	Silage; clover hay; cotton-seed meal, linseed meal, and dried-beet pulp.	45 00	6,000	385	5.5
30	6	do	do	Yes.	Few.	do	Pasture; corn and cob meal.	Alfalfa hay; bran, corn and cob meal.	34 00	5,994	319	.....
20	4	do	do	Yes.	Few.	do	Pasture; mixed feed; cotton-seed meal.	Silage; clover hay; mixed feed and cotton-seed meal.	46 50	6,000	340 365	.....
34	5	do	do	Yes.	Few.	Spring, fall.	Pasture; alfalfa hay; corn and oat chop.	Silage; alfalfa hay; shredded fodder; bran, corn and oat chop.	35 00	5,000	290	5.0
19	6	do	do	Yes.	.....	do	Pasture; 2 pounds bran.	Silage; hay; union grains, 5 pounds.	40 00	5,160	300	5.0
12	8	do	do	Yes.	Few.	Fall	.... do	Hay; corn fodder; corn and oat meal, 5 pounds; bran, 3 pounds.	35 00	6,000	364	5.2
100	5	.....	do	Yes.	.....	All times.	Pasture; bran when pasture is short.	Silage. 25 pounds; hay, 10 pounds; corn protegran, 3 pounds; corn bran, 2 pounds; oil meal, 1 pound.	35 00	5,000	.....	5.0

No. of Cows	Average Age	Breed	Breed of Bull	Cows Raised	Cows Purchased	When Fresh	Summer Rations	Winter Rations	Cost of Keeping Cow	Av'ge Annual Production		Average Fat in Milk
										Milk	Butter	
										Lbs.	Lbs.	P. ct.
35	5	Jersey.....	Jersey ...	Yes.	.....	All times.	Pasture; bran and dried brewers' grains.	Silage; hay; grain.....	35 00	4,000	240	5.3
50	3	do	do	Yes.	Few.	Spring,	Pasture; ground oats and bran.	Corn stover; hay; bran and ground oats.	35 00	.....	350	5.0
25	5	do	do	Yes.	Few.	Spring, fall.	Pasture; bran.....	Silage; bran and cotton-seed meal.	32 00	5,000	275	5.0
50	6	do	do	Yes.	Few.	All times.	Pasture; silage; alfalfa.	Silage; alfalfa, gluten feed, bran.	50 00	6,500	395	5.2
50	6	do	do	Yes.	Few.	do	Pasture; 1 quart bran and 1 pint cotton-seed meal.	Silage; hay; corn stover; bran and corn meal.	45 00	.....	300	5.0
27	4	do	do	Yes.	Few.	do	Pasture; bran and ship stuff.	Silage; clover hay; ship stuff, corn and cob meal	60 00	4,523	.....	5.0+
30	6	do	do	Yes.	Few.	Fall, winter.	Pasture; alfalfa; green-corn fodder.	Corn fodder; clover and alfalfa hay; bran.	.....	3,000	.....	5.0
25	5	do	do	Yes.	.....	Fall	Pasture; soiling crops; 6 to 10 pounds grain.	Silage; hay; oat fodder; corn stover; grain.	50 00	6,000	380	5.44
10	4	do	do	Yes.	Yes..	do	Pasture; rice bran and corn chop (4 to 6 pounds).	Hay; grain, 8 to 12 pounds (rice bran, corn chop, cotton-seed meal).	40 00	6,000–7,000	350–400	5.0
8	5	do	do	Yes.	.....	All times.	Pasture; corn and oats.	Corn stover; hay; straw; corn and oats, bran, oil meal.	.....	5,620	341	5.2
59	6	do	do	Yes.	Yes..	do	Pasture	.....	37 00	.....	383	5.4
20	5	do	do	Yes.	.....	Fall	Pasture; bran.....	Silage; fodder; mowed oats; bran, oil meal.	30 00	4,750	295	5.4
29	4	do	do	Yes.	Yes..	All times.	Pasture; hay; grain (bran and gluten).	Silage; mangels; corn fodder; hay; bran, gluten.	.....	7,500	.....	5.0
60	7	do	do	Yes.	Yes..	Fall, winter.	Pasture; alfalfa; gluten feed.	Silage; ground oats and cotton-seed meal.	48 50	.....	300	5.04
24	7	do	do	Yes.	.....	Fall	Pasture; corn and bran.	Silage; hay; corn meal, bran, gluten.	34.50	7,176	470	5.77

7	7	Jersey	Jersey....	.....	Yes..	All times.	Pasture; bran, corn and cob meal.	Corn stover; prairie hay; bran, cotton-seed meal, corn and cob meal.	30 00	4,790	.....	5.5
13	5	do	do	Yes.	Yes..	Fall	Pasture; bran.....	Alfalfa; clover hay; bran, shorts.	.....	6,765	469	.....
40	...	do	do	Yes.	.....	All times.	Pasture; bran, cotton-seed meal, gluten.	Silage, 40 pounds; hay, 5 pounds; gluten feed, cotton-seed meal, corn and oat chop, dried brewers' grains.	40 50	5,200	.....	5.35
35	3	do	do	Yes.	Few.	Fall, winter.	Pasture—Bermuda grass, Japan clover; soiling crops; bran, cotton-seed meal.	Bermuda hay; cotton-seed hulls, cotton-seed meal, bran, corn, oats; Japan clover.	36 00	4,000	350	.....
40	7	do	do	Yes.	.....	Fall	Pasture; bran, distillers' grains, 8 quarts per day.	Silage; grain, 12 quarts per day (bran, wheat middlings, distillers' grains).	.....	8,000	.....	5.2
26	5	do	do	Yes.	Few.	All times.	Pasture; "flakes"; silage when pasture fails.	Silage; clover hay and alfalfa; "flakes."	40 00	5,153	332	5.5
21	7	do	do	Yes.	.....	Fall	Pasture; silage; bran..	Silage; hay; bran, gluten feed.	35 00	7,665	.....	5.6
40	6	do	do	Yes.	.....	All times.	Pasture; alfalfa, green; alfalfa and corn silage.	Alfalfa and corn silage; alfalfa hay; oil meal, bran, distillers' grains, "XXXX."	36.00	7,060	408	5.1
18	6	do	do	Yes.	.....	June-Sept.	Pasture; alfalfa.....	Silage; alfalfa and oat hay.	30 00	5,500	400	.....
48	6	Red Polled...	Red Polled.	Yes.	Yes..	Fall, spring.	Pasture; after Aug. 1, sweet corn.	Mill feed; brewers' grains, corn, oats, oil meal.	35 00	6,000	300	4.4
22	10	do	do	Yes.	.....	All times.	Pasture; in early fall, sweet corn.	Silage; shredded corn fodder; hay; wheat shorts.	30 00	5,713	270	4.1
9	5	do	do	Yes.	Few.	Fall, winter.	Pasture; bran, corn, and oats.	Corn stover; hay; bran, corn, and oats.	.....	7,000–10,000	355	.....
28	7	Shorthorn ...	Shorthorn	Yes.	.....	All times.	Pasture; sweet corn...	Silage; corn and oats....	20 00	7,000	300	.....
60	7	do	do	Yes.	Few.	do	Pasture; grain.....	Silage, 20 pounds; hay, 10 pounds; grain, 7½	42 00	6,800	299	.....

A study of the above table shows that the annual cost of feeding a cow ranged, with the 95 dairymen reporting, from $16 to $75, the average being $40.36. The average of the milk yield reported by 99 dairymen was 7,093.1 pounds, and the average butter yield reported by 78 dairymen was 341.2 pounds. It should be remembered that most of these dairymen practiced up-to-date methods, were careful feeders as well as breeders, and kept careful records of their work. These records present a great contrast to those reported under creamery patron investigations.

CHAPTER V

RECORDS OF GRADE COWS

THE great mass of dairymen deal with the grade cow and will doubtless continue to do so for many years to come. The records of these animals are therefore more important to the average diary farmer. The following detailed descriptions and records of profitable dairy herds will serve to show the possibilities in production where herds are well managed and good business methods followed:

TABLE ——. MILK AND BUTTER-FAT RECORDS OF GRADE HERDS AND HERDS OF MIXED BREEDING FOR ONE YEAR

No. of Cows	Average Age	Breed	Breed of Bull	Cows Raised	Cows Purchased	When Fresh	Summer Rations	Winter Rations	Cost of Keeping Cow	Av'ge Annual Production		Average Fat in Milk
										Milk	Butter	
										Lbs.	Lbs.	P. ct.
42	8	Ayshires (mainly), Guernseys and Jerseys.	Ayrshire.	Yes.	.....	All times.	Pasture, and various soiling crops..	Hay; cut corn fodder; corn meal; wheat bran.	$60 00	8,000	370	4.0
20	5	Ayrshires (13), and grade Holsteins (7).	do	Yes.	Few.	do	Pasture; 2 quarts grain (bran, red dog middlings, corn meal, cotton-seed meal).	Early cut hay; rowen; Hungarian grass; 4 quarts grain.	45 00	6,600	308	4.0
6	5	Grade Ayrshires.	Holstein*	Yes.	Few.	Spring and fall.	Pasture; "stock food"; cotton-seed meal.	Mixed hay; "stock food"; cotton-seed meal.	55 00	6,450	375	5.0
32	7	Ayrshires (16) and scrubs (6).	Ayrshire.	Half	Half.	do	Pasture; silage; corn meal.	Silage; hay; bran and oats.	28 00	6,310	280	3.8
4	4	Ayrshires and Jerseys.	do	Yes.	.....	Fall	Pasture	Pea vines; corn fodder; ground oats; corn and bran.	30 00	.....	150	.....
24	7	Registered Ayrshires, registered Jerseys, and grades.	do	Yes.	.....	Fall and winter.	Pasture; oats and peas; hay when pasture is short.	Silage, 30 pounds; hay, 10 pounds; oat and buckwheat straw; bran, corn meal and buckwheat middlings.	35 00	6,000	280	4.0
150	...	Ayrshires (50) and Ayrshire grades (100).	do	Yes.	4th...	All times.	Pasture; 4 quarts bran and shorts daily.	Ensilage; bran and shorts; roots; hay; oil meal.	.....	5,000	264	4.52
20	8	Devons, Holsteins, and grades.	Devon....	Few	Yes..	Fall, winter, and spring.	Pasture; grain, 2 quarts (bran, one-half; wheat middlings, one-half).	Silage; clover and timothy hay; ground oats; corn meal, wheat and buckwheat middlings, and bran.	30 00	6,223	305	4.2

*The words Holstein and Holstein-Friesion used in this book are synonymous.

No. of Cows	Average Age	Breed	Breed of Bull	Cows Raised	Cows Purchased	When Fresh	Summer Rations	Winter Rations	Cost of Keeping Cow	Av'ge Annual Production		Average Fat in Milk
										Milk	Butter	
										Lbs.	Lbs.	P. ct.
30	2½	Holsteins and grade Holsteins.	Holstein.	Yes.	Few.	All times.	Pasture; bran and gluten.	Bran and gluten.....	35 00	6,000	210	3.05
50	5	do	do	Yes.	Few	do	Pasture; cut clover; oats and peas; cornstalks.	Silage, 40 pounds; hay, 5 to 10 pounds; beets; grain, 5 to 15 pounds.	45.00	7,701	270	3.02
40	7	do	do	Yes.	Few.	Fall and spring.	Pasture; sowed corn; brewers' grains.	Silage; hay; brewers' grain; grain (oil meal and corn meal; wheat mill feed, distillers' grains).	27.35	7,000	270	3–3.6
5	3	Holsteins (4), and Jersey (1).	do	.....	Yes ..	Fall and winter.	Pasture	Hay, corn stover; corn and oats and bran (one-third of each).	.....	6,175	258	3.58
70	7	Guernsey and Guernsey grades.	Guernsey	Yes.	Yes ..	Spring and fall.	Pasture; bran, oats, and corn.	Silage; hay; bran, oats, gluten.	50 00	6,200	350	4.9
50	6	do	do	Yes.	Few.	Fall and spring.	Pasture; bran (small quantity).	Silage, 35 pounds; corn stover; grain, 6 pounds (bran, gluten, and cotton-seed meal).	40 00	6,000	315	4.5
55	6	do	do	Yes.	Few.	.....	Cotton-seed meal and hulls; pea vine; cane; cut corn.	Silage; pea-vine hay; cotton-seed meal and hulls.	23 00	6,278	.....	.....
7	5	Grade Guernseys.	do	Yes.	Few.	Fall	Pasture	Corn stover; fodder corn; clover hay; upland hay; corn; oats and bran.	35 00	5,300	265	4.3
107	6	Grade Guernseys, grade Jerseys, and grade Holsteins.	do	Yes.	Yes ..	At all times.	Poor pasture; 20 pounds ensilage; 6 pounds mixed feed; 5 pounds hay; 3 pounds gluten feed.	Silage, 35 pounds; hay, 10 pounds; cotton-seed meal, 1½ pounds; corn meal, 3½ pounds; bran, 4 pounds.	55 00	7,665	364	4.2

30	8	Grade Guernseys; few grade Shorthorns.	Polled Shorthorn.	Yes.	.....	At all times.	Pasture; supplemented by green corn fodder.	Corn stalks; clover hay; straw; corn and oats.	38 00	5,805	303	4.5
125	3	Guernseys and half-bloods.	Guernsey	Yes.	Yes..	Fall and spring.	Pasture; hay; green alfalfa; silage; cotton-seed meal, barley, bran, gluten, oil meal.	Silage; hay; cotton-seed meal; barley; gluten; bran; oil meal.	78 00	6,800	367	4.63
20	5	Guernseys and grades.	do	Yes.	.....	All times.	Pasture; silage; bran and gluten when pasture is short.	Silage; hay; bran and gluten feed.	28 00	6,000	362	5.2
55	6	Guernseys (37) and Holsteins (18).	Guernsey 1; Holstein 1.	Yes.	Yes..	do	Silage; oats and peas; bran, oil meal.	Silage; alfalfa hay; bran and barley.	43 00	5,800	315	4.66
180	5½	Guernseys (35), Guernsey and Jersey grades (145).	Guernsey	Few	Yes..	do	Soiling crops—oats and peas, crimson clover, corn, millet, red clover; grain.	Silage, 25 pounds; hay; grain, 7 pounds (bran 800, gluten 1,000, middlings 200, linseed meal 100, corn meal 100, cotton-seed meal 200).	61 00	6,707	360	4.6
35	7	Guernsey and Guernsey grades.	do	Yes.	Few.	Fall and winter.	Pasture (blue grass); small amount bran in dry season.	Silage; hay; sorghum forage; bran and shorts (equal parts).	30 00	4,700	274	5.0
496	5	Jerseys and 10 per cent. high-grade Jerseys.	Jerseys; registered.	Yes.	.....	All times.	Hay and soiling crops; 2 quarts grain (bran 300, beet pulp 300, corn meal 150).	Silage; hay; 4 to 6 quarts grain (bran 500, beet pulp 500, corn meal 300, oil meal 200, gluten 200).	.....	5,197	349	5.6
20	3	Jerseys and high-grade Jerseys.	do	Yes.	.....	do	Pasture; supplemented with ensilage, green feed; bran and light feed of cotton-seed meal.	Silage, clover hay; bran; cotton-seed meal; gluten.	50 00	5,925	380	5.5

Low records of grade cows.—As a contrast to the preceding table, the following records of herds of 100 creamery patrons are presented to show the low profits realized by the average farmer in many parts of the country.

Records of Herds Owned by 100 Patrons of a Creamery

[Reported in Hoard's Dairyman]

Patron's Number	Number of Cows	Breed of Cows	Cost of Feed per Cow	Returns from Creamery per Cow	Yield of Milk per Cow	Returns for each 100 Pounds of Milk	Returns for each $1 Worth of Food Fed
					Lbs.		
1	8	Natives mostly	$42 70	$49 44	4,628	$1 07	$1 16
2	10	Natives and mixed breeds	33 80	48 36	4,655	1 04	1 43
3	10	do	35 50	27 43	2,756	99	77
4	7	do	36 28	31 00	3,198	97	85
5	17	Natives and grade Holsteins	34 12	37 40	3,630	1 03	1 09
6	7	Natives mostly	31 75	29 65	3,224	92	93
7	13	Grade Durhams	38 60	23 86	2,266	1 02	62
8	8	Natives and mixed breeds	42 00	70 33	6,393	1 10	1 67
9	16	do	35 40	37 29	3,856	96	1 05
10	8	do	31 25	22 97	2,428	95	73
11	13	Natives	39 25	38 86	3,754	1 03	99
12	8	Mixed breeds	38 88	46 97	4,463	1 07	1 21
13	9	Natives and grade Jerseys	51 10	66 80	5,572	1 20	1 30
14	12	Natives and mixed breeds	36 50	39 35	3,916	1 00	1 08
15	7	Grade Jerseys	40 00	43 13	4,394	98	1 07
16	8	Holsteins and grades	39 00	46 55	4,974	91	1 19
17	9	Grade Jerseys and Holsteins	42 00	49 75	5,197	96	1 18
18	19	Natives and mixed breeds	38 58	39 45	4,303	92	1 02
19	20	Natives	39 75	42 18	4,350	97	1 06
20	20	Natives and mixed breeds	42 25	35 57	3,605	99	81
21	25	Natives and grade Holsteins	36 90	42 30	4,325	98	1 15
22	7	Grade Jerseys and natives	37 10	28 91	3,067	94	78
23	13	Natives	33 23	37 21	3,675	1 01	1 12
24	30	Grades Holsteins and Jerseys	43 50	53 32	5,298	1 06	1 23
25	16	Natives mostly	31 25	39 64	4,211	94	1 26
26	6	Natives	37 80	48 15	4,500	1 07	1 27
27	24	Mixed breeds	42 38	45 38	4,508	1 01	1 07
28	10	Natives and mixed breeds	35 45	52 66	5,276	1 00	1 48
29	11	Grade Holsteins	35 10	50 07	5,266	95	1 43
30	10	Natives and mixed breeds	38 50	46 63	4,745	98	1 21
31	17	Natives and grade Holsteins	37 00	36 04	3,004	1 04	83
32	15	Natives	30 00	13 88	1,566	92	46
33	13	do	41 50	31 73	3,155	1 00	76
34	14	Natives and grade Holsteins and Jerseys	31 43	32 94	3,542	93	1 05
35	6	Natives and mixed breeds	44 65	35 66	3,874	92	80
36	15	Natives and grade Holsteins	38 20	45 60	4,466	1 06	1 19
37	20	Natives	37 90	18 60	2,021	92	49

(Continued on page 109)

Records of Herds Owned by 100 Patrons of a Creamery

(Continued from page 108)

Patron's Number	Number of Cows	Breed of Cows	Cost of Feed per Cow	Returns from Creamery per Cow	Yield of Milk per Cow	Returns for each 100 Pounds of Milk	Returns for each $1 Worth of Food Fed
					Lbs.		
38	19	Grade Jerseys	34 37	31 10	3,075	1 01	90
39	28	Holsteins and Jerseys	42 00	54 93	4,957	1 11	1 31
40	30	Natives	46 20	57 32	5,355	1 07	1 24
41	14	Natives and grade Jerseys and Holsteins	38 50	40 23	3,948	1 02	1 05
42	6	Natives and mixed breeds	41 50	64 50	6,303	1 02	1 56
43	27	Jersey and Holstein grades	40 48	38 90	3,885	1 00	96
44	5	Natives	40 20	45 13	4,438	1 02	1 12
45	50	Mixed breeds	36 10	32 54	3,187	1 02	90
46	24	do	36 50	46 56	4,680	1 00	1 28
47	20	Natives and mixed breeds	39 50	30 03	3,165	95	76
48	27	Natives and grade Jerseys and Holsteins	36 55	54 47	5,181	1 05	1 49
49	13	Holstein grades	39 00	29 93	3,063	98	76
50	10	Natives	36 40	39 71	4,168	95	1 08
51	30	Mixed breeds	38 50	53 63	5,520	97	1 39
52	8	Natives	42 20	48 13	4,813	97	1 14
53	15	do	31 60	29 38	3,228	91	93
54	15	Natives and mixed breeds	42 18	45 40	4,729	96	1 08
55	5	Natives	32 00	25 53	2,806	91	80
56	21	Natives and grade Holsteins	39 00	35 00	3,511	1 00	90
57	12	Mixed breeds	40 00	41 57	4,014	1 03	1 03
58	7	Holstein and Jersey grades	35 00	40 85	4,800	95	1 17
59	7	Natives	37 00	47 84	4,771	1 00	1 29
60	9	Mixed breeds	37 35	37 11	3,893	99	99
61	15	do	38 35	20 72	2,157	96	54
62	32	Natives and grades	43 00	35 91	4,029	89	84
63	10	Grade Jerseys	40 60	23 50	2,423	97	58
64	8	Natives and mixed breeds	40 20	26 50	2,812	94	66
65	19	Mixed breeds	39 50	39 83	3,966	1 00	1 01
66	20	Natives	32 00	28 64	3,198	91	89
67	21	Mixed breeds	40 00	30 06	3,209	93	77
68	10	Natives and Jersey grades	32 70	35 25	3,750	94	1 08
69	10	Mixed breeds	37 00	38 52	4,042	95	1 04
70	30	do	37 00	24 81	2,409	1 03	67
71	15	Natives and mixed breeds	38 72	41 68	4,041	1 03	1 08
72	20	do	40 60	46 44	4,551	1 02	1 14
73	21	Natives and grade Jerseys	37 00	25 16	2,780	91	68
74	13	Natives	41 00	41 18	3,877	1 09	1 00
75	15	Natives and mixed breeds	37 60	41 68	4,041	1 03	1 11
76	26	Natives mostly	40 50	33 60	3,140	1 07	80
77	13	Natives and mixed breeds	40 00	38 00	3,518	1 08	95
78	14	Natives	35 00	29 22	2,865	1 02	83
79	35	Natives and mixed breeds	40 00	38 06	3,696	1 03	95
80	14	do	39 60	39 57	3,967	1 00	1 00
81	20	do	38 60	34 31	3,534	97	89
82	21	do	43 25	47 65	4,814	99	1 10
83	13	High-grade Jerseys	33 00	32 47	3,184	1 02	98
84	12	Natives mostly	38 75	37 45	3,941	95	96
85	10	Natives and grade Holsteins	39 00	40 81	4,021	1 02	1 05

(Concluded on page 110)

Records of Herds Owned by 100 Patrons of a Creamery

(Continued from page 109)

Patron's Number	Number of Cows	Breed of Cows	Cost of Feed per Cow	Returns from Creamery per Cow	Yield of Milk per Cow	Returns for each 100 Pounds of Milk	Returns for each $1 Worth of Food Fed
					Lbs.		
86	15	Natives and mixed breeds.....	38 00	36 10	3,954	91	95
87	12	Natives	36 33	38 60	3,748	1 03	1 03
88	6	do	35 00	21 15	2,165	97	60
89	6	Natives and grade Holsteins....	35 66	35 42	3,472	1 02	99
90	18	Natives and grade Holsteins and Jerseys	41 50	50 35	4,795	1 05	1 21
91	19	Grade Jerseys and mixed breeds	39 40	41 18	4,078	1 01	1 04
92	17	Grade Holsteins	38 65	31 08	3,048	1 02	80
93	18	Natives and mixed breeds.....	38 55	29 17	3,078	99	86
94	8	Mixed breeds	36 52	41 11	4,237	97	1 12
95	10	Natives and mixed breeds.....	41 30	48 60	4,760	1 02	1 17
96	7	Natives and grade Ayrshires....	38 70	40 97	4,052	1 01	1 06
97	7	Natives	34 00	35 25	3,672	96	1 04
98	20	do	37 00	37 12	3,783	98	1 00
99	40	do	33 45	36 69	3,628	1 01	1 10
100	20	Natives and grade Holsteins....	40 70	51 10	4,782	1 05	1 20

It is shown in the preceding table that the cost of keeping a cow averaged a little over $35 per head and that the patrons received an average profit of 65 cents per cow a year. In other words, for every dollar expended, the average dairymen at this particular creamery received only $1.01, and 42 were paying more for feed than they received for their milk. Surely there is need of better business methods than those practiced by the average dairyman.

Causes of low yields.—With the majority of dairymen who fail to make a profit, the causes of low yields are poor rations and using poor cows to turn these rations into milk. Too many fail to appreciate the value of the silo, the value of forage crops to supplement the scanty pastures, particularly the alfalfa crop, and concentrated feeding stuffs to balance

rations, as factors in increasing the milk yield and reducing the cost of production. There were numerous examples in this same locality to show that 5,000 pounds of milk per cow per year were within the reach of every painstaking dairyman. Many are practicing the primitive methods of forty or fifty years ago and fail to adapt themselves to the demands of a progressive age. Further, they do not avail themselves of the education in dairying and agriculture so cheaply offered in the dairy and agricultural papers, farmers' institutes, bulletins from the Department of Agriculture, reading courses, and other sources.

CHAPTER VI

BUSINESS METHODS IN IMPROVING THE DAIRY HERD BY MEANS OF A PURE-BRED SIRE

WHILE raising the heifer calves from cows showing good dairy performance is of great importance in improving the dairy herd, as shown in a previous chapter, the fact should not be overlooked that the calf inherits the qualities of both parents and, as will be shown in what follows, the sire is of even more importance than the dam. One does not need to go very far among dairy farmers to find herds where little or no attention is given to the selection of the sire. A scrub bull of any breeding is considered good enough to be the parent of the calves

which are to become the future herd. Some one says the purebred sire costs more. Certainly. Quality has to be paid for, wherever we find it. But isn't it worth the price? We cannot expect to get something for nothing, even in breeding. But let us follow up this matter and see what a good sire is really worth to a dairyman. With the first progeny the male has furnished half the qualities provided the parents are equally prepotent. But the cow has but one calf a year, while the bull may have sired all the calves in the herd, if it is of ordinary size, and if he is a strong individual, of good type, the chances are that he will be more prepotent than the cows, particularly if it is a grade herd. His influence, then, will be as much and possibly more than all the cows in the herd taken together. With each generation of calves the improvement increases, and the good qualities become more firmly fixed, while the defects from the dam decrease, and in time the bull may become practically the whole herd. If he has been well bred and his influence has been good it is possible for the sire to be the means of more than doubling the production and hence the profits of the herd. Looking at this from a business standpoint, then, the evidence is clear that the most careful attention should be given to the selection of the sire. His ancestry is of even more importance than that of the cow, and care should be taken that he comes from a good milking strain; he should be purebred in order that his characteristics may be well fixed, and consequently have more influence than a grade dam. He should show vigor and good

individual type. Such a sire need not cost more than one-tenth of the grade herd which he heads, yet he may have the most influence in the improvement of the herd.

Service records.—One of the essential things on a dairy farm is to keep a careful record of the date of service of all cows, the name of the bull employed, date of calving, sex of calf, and whether raised or sold. The accompanying form will serve as a suggestion for keeping such records. It was used for a number of years by the author, and found practicable.

Raising the cows from best calves.—Many dairymen are not raising their heifer calves. They are sold for veal, whether good or bad. Provision should be made for perpetuating the dairy herd, particularly the best cows in it, otherwise the best blood is soon gone and splendid opportunities for building up the herd thrown away. This is a serious practice and should be carefully considered by every dairyman. He can well take a lesson here from the careful breeder who makes every effort to perpetuate the blood of his best animals, and frequently resorts to the practice of inbreeding to intensify good qualities. The custom of buying all the cows has a tendency to lower rather than raise the standard of the herd, for the reason that few of the best cows are for sale, and a dealer can supply his purchasers with only a limited number of good cows.

The dairyman who raises his own cows is independent of the cow-dealer and is more certain of good stock in the end. Heifers raised from the best

GENERAL SERVICE RECORD

Date of Service			Name of Cow	Herd Register No.	Name of Bull	Herd Register No.	Due to Calve	Calved	Sex of Calf	Remarks
Year	Month	Day								

cows are frequently better milk producers with their first calves than the cows ordinarily purchased.

Not expensive to raise cows.—It is a mistaken idea that it costs too much to raise cows. The Illinois Experiment Station carefully investigated this subject by raising 48 calves. Records were kept of 12 at a time during four different periods. It was found that they could be successfully raised on 150 pounds of whole milk costing $1.50, and 400 pounds of skim milk costing $1.20. This milk was fed at the rate of 10 pounds per day until the calves were 50 days old, when it was gradually lessened to one pound per day for ten days, when no more was fed. Only the ordinary grains which the farmer produces and a good quality of legume hay were fed, showing that the dairyman can raise a calf in this way with little trouble.

Successful dairymen state that they raise heifer calves at a cost of $18 to $20 up to the time they are two years old, and frequently sell them for $50 at this age. Even if it cost twice the above amount to raise them there is a good margin of profit. This is a good business proposition and shows that it is better to raise cows than to buy them.

That the dairyman should raise his own cows is one of the fundamental elements of profitable dairying, and the lack of application of this principle is responsible for a large per cent. of the poor herds in this country. That the cow's capacity for large milk production is likely to be transmitted to her daughter is well illustrated in the following examples:

Year	Dam			Daughter No. 1			Daughter No. 2			Daughter No. 3			Daughter No. 4		
	Milk Lbs.	Fat %	Fat Lbs.	Milk Lbs.	Fat %	Fat Lbs.	Milk Lbs.	Fat %	Fat Lbs.	Milk Lbs.	Fat %	Fat Lbs.	Milk Lbs.	Fat %	Fat Lbs.
1st year ...	10,169.7	4.1	415.11	6,978.8	4.53	302.76	6,275.0	4.10	257.85	6,414.5	4.69	300.22	6,704.4	5.07	339.81
2d year....	9,164.1	4.1	372.64	7,135.6	4.20	302.60	5,291.1	5.02	265.14	7,132.5	4.51	321.51			
3d year....	8,444.1	3.9	331.20	8,496.2	4.32	366.23	7,302.8	4.73	345.47						
4th year...	8,857.1	4.07	360.22	9,313.4	4.36	406.26									
5th year...	6,275.0	4.1	257.01	9,427.6	4.40	414.34									
6th year...	7,622.1	3.94	300.63												
7th year...	7,266.8	3.79	275.32												
8th year...	5,688.9	3.97	226.20												

The dam was a grade Holstein and was bred in every case to a purebred Guernsey or Ayrshire bull.

COW TEST ASSOCIATIONS PROMOTE BUSINESS METHODS

What they are.—Cow test associations are organizations of dairy farmers having for their object the determination of the economical production of the individual cows in the herd. The plan commonly followed is for a number of dairymen having a total of 300 to 500 cows to organize, elect officers, adopt constitution and by-laws, and perhaps give the officers power to employ a man to do the testing. The tester should be a practical and tactful man, having a thorough knowledge of his business. He need not necessarily be a college graduate; often "Short Course" students make splendid men for this work.

How the work is done.—The tester visits each herd once a month, weighs the milk of each cow for a period of twenty-four hours, takes samples of some and analyzes them for per cent. of butter fat, weighs the feed that each cow is receiving, figures out the cost of the ration, puts the record in his book, leaves a copy for the dairyman, gives him all the helpful suggestions possible, and proceeds to the next herd, returning again in about a month. The entire cost to the dairyman for a year is about one dollar per cow in addition to boarding the tester during his stay at the farm. If there were 400 cows in the association, this would amount to a salary of $400 and board for the tester. The tester says to the dairyman, "For the sum of one dollar per cow, I will tell you just how much profit or loss every

cow in your herd is giving you." Every dairyman ought to take advantage of this splendid opportunity of having so much of the business end of his work figured out for him at so nominal a cost. State experiment stations, State dairy associations, and State dairy and food departments often give valuable assistance in organizing cow test associations.

Results.—Cow test associations have had a tremendous influence in improving dairy herds, particularly in Denmark, where the first association was organized in 1895. In 1884 the average yield of butter fat per cow annually in that country was about 100 pounds and in 1903 it had increased to 212 pounds, or over 100 per cent., and largely through the influence of 425 cow test associations. Scores of associations have now been organized in this country, the first one being in Fremont, Michigan.

To give one illustration of the difference found in the profits returned by individual cows through these associations: The best cow in one herd returned to the owner $2.29 for each one dollar's worth of feed and the poorest cow returned but 54 cents for each dollar's worth of feed, or, considering that the skim milk, calf and manure offset the labor, this cow was losing for the dairyman 46 cents for every dollar's worth of feed she ate. We must study dairying as a business proposition. It is not the size of the cow, or the breed, or the color or the pedigree, or the yield that we want to know, it is the economical production. How much profit is there after the bills are paid?

Cow test associations set the dairyman to thinking. If he is not getting as much profit as his neighbor he asks why? These associations set the farmer to reading; as a result, he keeps better cows, feeds better feeds, builds a silo, buys a purebred bull, keeps his stable clean, puts in light and ventilation, and takes more pride in his work generally. If a dairyman wants better prices for his products and a better profit, he must go after what he wants, and the Cow Test Association will help him to get it. He is certain of cheaper production if he disposes of the poor animals for better ones. It is simply a question of applying business methods.

By-Laws of the Newaygo County Dairy Testing Association

Adopted at first meeting, October 31, 1905.

ARTICLE I. ANNUAL AND SPECIAL MEETINGS

The annual meeting of the members of this corporation shall be held at a place to be designated by the board of directors in the village of Fremont, Michigan, on the first Monday of November of each year at two o'clock in the afternoon for the purpose of electing a board of directors and for the transaction of such other business as may lawfully come before said meeting.

Special meetings may be called by the board of directors and notice thereof shall be given by the secretary by mailing to each member a written or

printed notice thereof at least five days prior to such meeting. Such notice shall state the object of the meeting, and no other business shall be transacted thereat.

ARTICLE II. BOARD OF DIRECTORS

SECTION 1. The board of directors shall consist of nine members. They shall be elected at each annual meeting, the first election to be held on the first Monday of November, A.D. 1906.

SEC. 2. The board of directors shall have the management and control of the business of the corporation, and shall employ such agents and servants as they may deem advisable, and fix the rates of compensation of all officers, agents and employés.

SEC. 3. Whenever any vacancies shall occur in the board of directors by death, resignation or otherwise, the same may be filled without undue delay by the majority vote of the remaining members of the board. The person so chosen shall hold office until the next annual meeting or until his successor is elected and qualified.

SEC. 4. The board of directors shall meet on the first Monday of every month, at such times and in such places as they may by resolution determine.

SEC. 5. A majority of the directors shall constitute a quorum at all meetings of the board.

ARTICLE III. OFFICERS

SECTION 1. The officers of the corporation shall consist of President, Vice-President, Secretary and Treasurer. The office of Secretary and Treasurer

may be held by the same person. The officers shall be elected by the board of directors by a majority vote of the whole number of directors. The first election shall be held immediately after the organization of the board. Subsequent elections shall be held annually on the day of the regular meeting of the board next ensuing the annual election, the day to be fixed by resolution of the board of directors.

SEC. 2. In case of death, resignation or removal of any officer, the board shall elect his successor, who shall hold office for the unexpired term.

ARTICLE IV. MEMBERSHIP

Any person acceptable to the board of directors may become a member upon paying a membership fee of 25 cents.

ARTICLE V. DUES

Each member shall pay a fee of 25 cents annually on or before the first Monday of November. The first annual dues to be payable on or before the first Monday of November, 1906. No member shall be allowed to participate in the election of the board of directors who shall not have paid his annual dues in advance.

ARTICLE VI. AMENDMENTS

These by-laws may be amended, added to or altered by a majority vote of all members present at annual meeting or at a special meeting called for that purpose.

Articles of Association of the Newaygo County Dairy Testing Association

We, the undersigned, desiring to become incorporated under the provisions of Act No. 171 of the Public Acts of 1903, entitled "An act for the incorporation of associations not for pecuniary profit" and the acts amendatory thereof and supplementary thereto, do hereby make, execute and adopt the following articles of association, to wit:

ARTICLE I

The name by which said association shall be known in law is Newaygo County Dairy Testing Association.

ARTICLE II

The purpose for which it is formed is generally to promote the dairying interests of its members and particularly to provide means and methods for testing the milk of cows of the members periodically.

ARTICLE III

Its principal office and place of business shall be at Fremont, Michigan.

ARTICLE IV

The number of its directors shall be nine.

ARTICLE V

The names of the directors selected for the first year of its existence are as follows: John Dobben, Dirk Kolk, Gerhard Stroven, Chris Wils, George

Klooster, John Beem, Henry Wilcox, Wilks Stuart and Henry Rozema.

ARTICLE VI

Any person may become a member of this association and be entitled to all its benefits and privileges upon being accepted by its board of directors and upon complying with the requirements of its by-laws.

PART IV—FEEDS AND FEEDING

CHAPTER I

BUSINESS METHODS IN FEEDING

THE business man aims to secure the largest returns possible for every dollar expended. There is no business that requires more carful study and forethought to accomplish this than that which rests upon the dairyman when he faces the problem of providing a palatable and well-balanced ration for a dairy herd. The dairyman must not only be a good producer and intelligent buyer, but it is fully as important that he be a careful feeder. Give him the best cows obtainable and it is possible for him to feed them so sparingly or so wastefully that they will not return a dollar's worth of profit. The question of careful feeding becomes more important as the variety of crops multiply and new feeds are added to those already in the market.

Proper feeding must begin when the animal is young. If we feed the growing heifer nitrogenous foods to develop muscle and bone and an abundance of coarse fodder to develop a capacity for digesting and assimilating a large amount of food, we may expect these characteristics to show to a greater or less extent in the full-grown cow. On the other

hand if the cow is fed in calfhood largely carbonaceous and fat-forming foods, whatever breed we may have at the start, we must expect, as a result of this method of feeding, an animal having a tendency to lay on flesh readily and with dairy qualities poorly developed. After a cow has begun to produce milk, still more attention should be given to supplying her with a balanced ration if large yields are to be obtained.

The proper feeding of a dairy cow is a science which may be defined as supplying food in the right proportion to meet her various requirements without a waste of food nutrients. The chemist and the animal physiologist have carefully worked out the principles of feeding. It is left for the dairyman then to know his arithmetic and to spend a little time in learning the composition, digestibility and characteristics of the different food stuffs and in studying the needs of his individual animals. Careful study has been made of these with different animals under different conditions and the requirements of animals for the various food nutrients when at rest, at work, giving milk, producing wool, pork, beef, mutton, etc. The applications of the various feeding stuffs in practice, their cost and special adaptations must, of course, be considered.

Composition of the animal body.—In order that we may have an intelligent idea of the feeding problems and work out practical methods, we will discuss briefly the various substances found in the animal body.

Water.—The principal constituent, in respect to

quantity, and comprises from 40 to 80 per cent. of the gross weight. While indispensable, it has but little economic importance here.

Ash occurs principally in the bones and constitutes from 2 to 5 per cent. of the live weight. The term is applied to the residue left after complete burning.

Protein.—This is the constituent which forms flesh and includes all the nutrients which contain nitrogen; albumenoids being the most important. Familiar forms of this nutrient are lean meat, white of the egg, and the casein of milk (curd). The flesh, skin, bones (in part), vital organs, brain, nerves, in fact the bodily mechanism, are made up of protein diluted, so to speak, with water, supported by the ash of the skeleton and rounded out with fat. Protein is therefore of the utmost importance.

Fat comprises from 6 to 30 per cent. of the live weight in different classes of animals and is usually well distributed in the body. It consists of carbon, hydrogen and oxygen, but contains no nitrogen. While not so vital to the animal life as the other three constituents, it has much economic interest.

These various substances are formed from animal, vegetable, and mineral matter known as food and are converted by the animal eating them into flesh, fat, bone, milk, wool, and work (energy). It is of interest, therefore, to consider next the composition of vegetable matter, or the food of animals.

Composition of food materials.—There is a similarity between the constituents of animals and plants. The four groups of substances cited under

the composition of animals—namely, water, ash, protein and fat—are also found in the food they consume, and in addition the food of herbivorous animals contains a class called carbohydrates, which includes cellulose, woody tissue, starch, sugar, gums, etc. While the individual substances which comprise the groups when they are of vegetable origin, are quite different from those in the animal body, these differences are not important in this consideration. In other words, water, ash and true fat are quite alike, whether found in plants or animals.

Water is a constituent of all food stuffs, however dry they may seem. The amount may be only 8 to 15 pounds per 100 pounds of material, as in hay, straw or grain, but in green corn fodder or silage it amounts to 75 to 80 pounds, and in some roots to 90 pounds. This water, although it may add to the palatability of food, is of no more benefit to the animal than the water in the food it drinks. Because of the variation in the proportion of water, the comparisons of foods are usually made on the dry or water-free basis, which shows the percentage of food ingredients in the dry matter.

Ash.—As already stated, this is what is left after burning, and consists of lime, magnesia, potash, soda, and various other compounds, and is used largely in making bone. Ordinary combinations of feeding stuffs contain an abundant supply of mineral matter for the requirements of the animal, so it is not given important consideration, only as far as it has a bearing upon the mineral elements of fertility in the manure.

Fat.—The so-called fats of fodders and feeds is impure, being mixed with wax, resins, coloring matter, etc. These materials are also extracted from a fodder by boiling ether, hence are called *ether extract.*

Carbohydrates.—Substances which come under this class are usually divided into two groups: (1) Nitrogen-free extract, a term applied to a somewhat miscellaneous group of nutrients, none of which contains nitrogen. Its principal constituents are starch, sugar, gums, and similar substances. (2) Cellulose or fiber, the essential constituents of the walls of vegetable cells. Example, cotton fiber and wood pulp, which are nearly pure cellulose. Coarse fodders like hay and straw contain a large proportion of fiber, while most grains contain but little.

Protein.—Nitrogenous compounds is the name of a group of materials containing nitrogen. All other constituents of feeding stuffs, the ash, fat, and carbohydrates, are non-nitrogenous or free from nitrogen. Protein materials are often designated as "flesh formers" because they furnish the materials for lean flesh, but they also enter largely into the composition of blood, skin and muscles, the casein and albumen of milk, etc. No substance free from nitrogen can take the place of protein. It is absolutely necessary then to have it in the ration if the animal is to grow or maintain existence. Protein is held by some to be a stimulant to milk production.

1. **Chemical analyses of feeding stuffs.**—For the practical dairyman the chemical analysis of fodders and feeds showing the crude nutrients they contain

is of little direct value. It is essential for him to know, however, in case of each feeding stuff, what part of the protein, fat and carbohydrates as shown by analysis is actually digested by the animal. This knowledge has been gained by digestion experiments which have been repeatedly conducted at various experiment stations with a large number of animals under different conditions. As a result of this careful work we have a fair knowledge of the digestibility of all common feeding stuffs and the computation of rations has become a simple problem in arithmetic. It may be said, in passing, that the rates of digestibility are not equal for the same nutrient in different foods, hence each crude nutrient has its respective digestion coefficient (proportion digested expressed as percentage).

Feeding standards.—Standards at best can only be used as guides. Successful feeding embodies something besides problems in mathematics, and animal life and nutrition are too complex to be solved in this way. It is necessary to study the requirements of individual animals, their varying capacities, ability to produce, effect of various feeds upon the health and condition of the animal, and its appetite, and effect upon quality of the product, in order to obtain the maximum production at the minimum cost. These are some of the problems that must be considered by the skilful feeder if the best results are to be secured.

Much experimental work has been done in this country and in Europe with a view to determining the fundamental laws of nutrition to be used as a

basis for the economical practice of stock feeding. While our knowledge of these principles is not perfect, sufficient information is at hand to give us a pretty clear idea of the food requirements of farm animals.

It should be understood at the outset that all standards are the result of practical experience and careful observation. Their function is to act as guides and suggestions rather than to serve as rules to be strictly followed regardless of differences in individuals, breeds, food stuffs, climate, care, amount of product, etc. These varying conditions once appreciated, the use of a standard is of great value.

Strictly speaking, then, a standard should express the proportions of digestible nutrients best adapted to the needs of various animals and to the purposes for which stock is kept.

Advantages of a feeding standard from a business standpoint.—The question naturally arises, with so many standards and so many limitations, and with cows, fodders and feeds of all sorts and descriptions, is it wise to attempt to follow a standard in feeding? This question can be answered positively in the affirmative. By adopting a standard, the dairyman will give closer attention to his cattle, their care and their feeding. Without a standard, there is danger of the dairyman feeding too little or too much, or an unbalanced proportion of nutrients. In the first instance the result would be lower production and possibly shrinkage in bodily weight. If the nutrients are not in proper proportion the result is

waste, or in some instances the production of flesh rather than milk. If the animals are overfed their health is endangered, the quality of the product is impaired, and there is also waste. In any case the feeder should study carefully his own conditions. He must determine for himself whether greater profit will follow large production coupled with greater cost, or low production with less expenditure; whether it will pay better to feed largely home-grown foods and a fairly wide ration, or to sell some foods and buy others which will add more of the nutrient protein to the ration, thus making it narrower. Ordinarily with good cows, good markets and a reasonable price for concentrated feeds, approximate conformity to standards will be found most profitable.

Calculation of rations.—The feeding of the dairy cow is a science which may be defined as supplying food in the right proportion to meet the various requirements without a waste of food nutrients. The process of calculating a ration is much simpler than it appears at first. With certain coarse foods and grain feeds at hand, definite weights are provisionally chosen, the total dry matter and digestible nutrients are determined and the result compared with the standard. If the result is close to the standard the work is done, otherwise the additions or subtractions are made, or possibly some other foods are substituted until the standard is reached. An example will best explain how a ration is calculated. Let us as a preliminary trial take some feeds commonly used on dairy farms, as corn silage,

mixed hay, wheat bran and corn and cob meal. (See Appendix.) For a trial ration we will combine the feeds in the following proportion (these amounts the author has frequently found in use by dairymen):

	Dry Matter	Protein	Carbohydrates + (Fat × 2.25)	Total Nutrients	Nutrient Ratio
35 lbs. Corn Silage.. .	7.35	.315	4.515	4.830	
10 " Mixed Hay....	8.70	.620	4.600	5.220	
5 " Wheat Bran...	4.40	.610	2.265	2.875	
5 " Corn & Cob Meal	4.25	.220	3.325	3.545	
Total.....	24.70	1.765	14.705	16.470	1 : 8.3
Wolff's Standard.....	24.00	2.5	13.4	15.9	1 : 5.4

Comparing the nutrients furnished by this ration with Wolff's standard, as given in table, we find that while the dry matter and nutrients are not far from the standard, the protein is much too low, the carbohydrates and fat are somewhat too great and the nutritive ratio too wide. Had we studied carefully the nutritive ratio of the four feeds entering into the ration we should readily have seen that with the exception of wheat bran they are all wider than the standard. It is evident that one of the three grains must be substituted for one that is richer in protein, or, in other words, a very narrow nutritive ratio. Consulting the table, we find that among such are linseed meal, cottonseed meal, gluten feeds, brewers' grains, etc. As cottonseed meal is one of the richest, and furnishes protein at a comparatively low cost, we will substitute two pounds of this for two pounds of the corn-and-cob meal in the ration.

Again taking the figures from the table (Appendix), we have:

	Dry Matter	Protein	Carbohydrates + (Fat × 2 25)	Total Nutrients	Nutrient Ratio
35 lbs. Corn Silage....	7.35	.315	4.515	4.830	
10 " Mixed Hay....	8.70	.620	4.600	5.220	
5 " Wheat Bran...	4 40	.610	2.265	2.875	
3 " Corn & Cob Meal	2.55	.132	1.995	2.127	
2 " Cottonseed Meal	1.84	.744	.888	1.632	
Total.....	24.84	2.421	14.263	16.684	1 : 5.89
Wolff's Standard.....	24.00	2.5	13.4	15.9	1 : 5.4

Comparing this ration with the standard we find it corresponds very closely. While the substitution of cottonseed meal for the corn-and-cob meal adds somewhat to the expense, it is the experience of careful feeders that the increased returns will more than pay for properly balancing the ration. The same result might be obtained by substituting other feeding stuffs, and the selection should be made by determining which can be most economically used to supplement the home-grown foods. By formulating a properly balanced ration containing each of the foods under consideration, and by assigning the actual market values per pound to each of the feeds in the ration, the cost can readily be ascertained and the cheapest selected.

CHAPTER II

OBSERVATIONS BY HAECKER*

It has long since been recognized that because of the difference in composition of the various kinds of feed stuffs no single standard of composition for all feeds would be practicable, and yet, while there is as

*Bull. No. 79, Min. Exp. Station.

great a difference in the composition of milks as there is in feed stuffs, there has been no adjustment of the nutrients in the ration to the quantity and character of the solids contained in the milk yielded, though, as has been shown, such an adjustment appears to be quite simple and practicable. If in formulating a ration it is deemed necessary in economic milk production, to take note of the fact that one feed stuff contains 12 per cent. of protein and another 20 per cent., is it not equally important in our attempt to adjust the ration to the needs of the cow in milk production to also take into account the fact that one cow may give milk containing 3 per cent. fat while that of another may contain twice as much? It would seem quite as consistent to feed an animal food regardless of its composition as to feed an assumed balanced ration regardless of the composition of the product which is to be elaborated from the nutrients in the food.

Great stress has been placed upon the fact that the nutrients in milk have a nutritive ratio of approximately one to five, and that therefore the ration for a milch cow should have a similar nutritive ratio; apparently overlooking the fact that only about 50 per cent. of the ration is used in milk production and the balance for maintenance of body. If note is taken of the fact that about half the ration is used for maintenance and that the maintenance ration has a nutritive ratio of 1 to 10, it becomes apparent that for the production of milk of average quality by an animal of average milk producing powers the nutritive ratio of the ration should be approxi-

mately 1:7.5. But since animals vary in productive powers, and since this variation is not in proportion to weight of body, it follows that if rations are adjusted to the actual requirements of animals the nutritive ratio of the rations will also vary.

The tables of nutrients required to a pound of milk ranging in per cent. fat from 2.5 to 6.5, are printed on pasteboard cards 7x3½ inches, and on the reverse side a table giving the nutrients in a pound of ordinary feeding stuffs. Given the daily yield of milk in pounds, its per cent. of butter fat, and the weight of the cow expressed decimally, it is an easy matter to determine the required ration. As an illustration, suppose a mature cow weighs 825 pounds, gives 20 pounds of milk daily, testing 4 per cent. butter fat. One pound of 4 per cent. milk requires of protein .0467, carbohydrates .214, and of ether extract, .0159. Multiplying these factors by 20 it is found that for the production of milk she needs .934 of protein, 4.28 of carbohydrates and .318 of ether extract. For food of maintenance multiply .07 protein, .7 carbohydrates and .01 of ether extract (maintenance formula) by 8.25, which gives protein .578, carbohydrates 5.78 and ether extract .082; adding to this the nutrients required for milk production, we have 1.51 of protein, 10.06 carbohydrates and .40 ether extract, the nutrients required in the ration. They should be supplied in such manner with reference to bulk that it will satisfy the appetite. A ration like this should be largely made up of roughage.

But suppose a cow weighing 850 pounds yields

40 pounds of 4 per cent. milk daily, the required ration would be:

Pro.	C. H.	Fat			Pro.	C. H.	Fat
(.0467	—.214	—.0159)	x 40	=	1.868	— 8.56	—.636
(.07	—.7	—.01)	x 8.50	=	.595	— 5.95	—.085
				Ration required,	2.463	—14.51	—.721

A ration like this should be largely composed of grain so that it will not contain so much bulk that she will go off her feed, and yet furnish the nutrients required. If a cow's ration is adjusted in bulk with reference to her feeding capacity and in nutriment content to the work she is doing, she will not be overfed nor go off her feed. A cow will not do her best unless she is so fed that she is satisfied, but the ration should not contain more nutriment than she actually needs. From this it follows that cows do not require a uniform nutritive ratio in their rations, but that it varies according to the quantity of milk yielded and weight of cow.

To illustrate, let us take a cow weighing 1,200 pounds and yielding 20 pounds of milk daily, and one weighing 850 pounds yielding 40 pounds of milk, both testing 4 per cent. fat.

	Pro.	C. H.	Fat
Nutrients for 1 lb. of 4 per cent. milk..	.0467	.214	.0159
Nutrients for 1 cwt., maintenance.....	.07	.7	.01

For cow weighing 1,200 pounds and yielding 20 pounds of 4 per cent. milk:

	Pro.	C. H.	Fat	
Nutrients for 20 lbs. milk.....	.93	4.28	.32	
Nutrients for 12 cwt. maintenance...	.84	8.40	.12	
Ration required.....	1.77	12.68	.44	
Nutritive ratio.....				1:7.7

For cow weighing 850 pounds and yielding 40 pounds of 4 per cent. milk:

	Pro.	C. H.	Fat	
Nutrients for 40 lbs. of milk.....	1.87	8.56	.64	
Nutrients for 8.5 cwt. maintenance..	.59	5.95	.08	
Ration required.....	2.46	14.51	.72	
Nutritive ratio.....				1:6.5

But if the cow weighing 12 cwt. yields 40 pounds of milk per day and the cow weighing 8.5 cwt. yields 20 pounds, the nutrient requirements for their respective rations according to table will be as follows:

	Pro.	C. H.	Fat	
Nutrients for 40 lbs. of 4 per cent. milk	1.87	8.56	.64	
Nutrients for 12 cwt. maintenance...	.84	8.40	.12	
Required ration.....	2.71	16.96	.76	
Nutritive ratio.....				1:6.8
Nutrients for 20 lbs. of 4 per cent. milk	.93	4.28	.32	
Nutrients for 8.5 cwt. maintenance..	.59	5.95	.08	
Required ration.....	1.52	10.23	.40	
Nutritive ratio.....				1:7.3

In prescribing rations upon the basis of flow and quality of milk and weight of cow and using the factors given in the table the nutritive ratio becomes a factor of very little importance the same as is the case with dry matter in a ration. If the nutrients required or a given flow of milk are provided for in the concentrates the food of maintenance may be secured by feeding at least a portion of the roughage *ad lib.* If the grain mixture has a nutritive ratio of 1 to 5 or 5.5 it will fairly meet the requirements.

In adjusting rations for cows fresh in milk note should be taken of surplus nutriment stored in the body during the time that a cow goes dry. If she gained rapidly in weight and is well rounded out with fat she will be able to do normal work during the first few weeks of her lactation on a light grain ration, for she will use the stored fat in generating body heat and energy and may also use some in the elaboration of milk solids. So as this milking-down in body weight takes place the concentrates should be gradually increased so that she will be on full feed by the time she reaches her normal working weight. From then on the amount of concentrates should be as constant as the flow of milk will permit until after the sixth month of gestation, when it should be gradually decreased so she will go dry during the seventh, when a couple of pounds a day will suffice.

The deduction from the data indicates that the Wolff feeding standard for dairy cows is fairly correct in the average amount of total nutriment required, but faulty in that it prescribes an excess of protein and in the assumption that cows need nutrients in proportion to their weight.

That the Wolff-Lehmann standard is faulty in that it prescribes an excess of protein and other nutrients, does not designate the nutrients required upon a basis of a unit in weight of milk; does not recognize the fact that quality of milk yielded should be considered as well as quantity, nor that heifers require more nutrients for a given flow of milk than mature cows.

That the nutrient requirements in milk production depend:

1. Upon the weight of the cow.
2. Upon the quantity of milk yielded.
3. Upon the quality of the milk, and
4. Upon the age of the cow.

During the past few years we have analyzed some 2,000 milkings by the gravity process, and comparing the composition of the milk with the nutrients consumed in its production, we find that the net nutriment, that is, the nutriment in a ration available for product, requires 1.75 of nutriment to one of product yielded. That is, reducing the digestible matter in the productive part of the ration to a common energy value, and the milk solids yielded to a common energy value, it requires 1.75 units of nutriments to produce a unit of product. Whenever a cow consumes more than this we find she gains in weight, and if she receives less, she either shrinks in milk or loses in body weight. Applying this general rule in feeding practice, we find that in addition to the food of maintenance a cow needs 1.75 of nutriment to a unit of product.

Some claim that some cows will yield more product for a unit of feed than others. We find that such is not the case if a cow is under normal condition. The reason why they feed some cows more for a unit of product than others, is that the cow will consume the feed, though she does not need it, and it takes several months for some cows to begin to utilize the surplus nutriment in making body gain.

UNIVERSITY OF MINNESOTA—AGRICULTURAL COLLEGE

Nutrients in a Pound of Feeding Stuffs

	Pro.	C. H.	Fat
CONCENTRATES			
Corn	.079	.667	.043
Barley	.087	.656	.016
Oats	.092	.473	.042
Wheat	.102	.692	.017
Rye	.099	.676	.011
Millet	.089	.450	.032
Kaffir corn	.078	.571	.029
Sorghum	.070	.521	.031
Shorts	.122	.500	.038
Bran	.129	.401	.034
Peas	.168	.518	.007
Corn oil meal	.202	.445	.088
Gluten feed	.233	.507	.027
Oil meal	.293	.327	.070
Gluten meal	.322	.422	.025
Cotton, S. M.	.372	.169	.122
ROUGHAGE—CURED			
Fodder corn	.025	.346	.012
Stover	.017	.328	.007
Sorghum	.024	.321	.016
Timothy	.028	.434	.014
Prairie hay	.029	.415	.012
Red top	.048	.469	.010
Oat hay	.043	.464	.015
Millet	.032	.485	.010
Marsh hay	.024	.299	.009
Soy bean	.109	.401	.015
Cowpea	.107	.382	.012
Clover	.038	.358	.017
Alsike	.084	.425	.015
Alfalfa	.110	.396	.012
ROUGHAGE—GREEN			
Fodder corn	.010	.116	.004
Sorghum	.003	.122	.004
Oats	.023	.189	.010
Timothy	.012	.191	.003
Red top	.021	.212	.003
Clover	.020	.148	.007
Alsike	.027	.121	.006
Alfalfa	.039	.127	.005
Cowpea	.018	.187	.002
Soy bean	.031	.110	.005
Barley	.019	.102	.004
SILAGE			
Corn	.009	.113	.007
Sorghum	.006	.141	.002
Cowpea	.015	.003	.009
Clover	.020	.135	.010
Soy bean	.027	.087	.013
Alfalfa	.030	.085	.019
MISCELLANEOUS			
Potato	.009	.163	.001
Sugar beet	.011	.102	.001
Mangel	.011	.054	.001
Turnip	.010	.072	.002
Rutabaga	.010	.081	.002
Cabbage	.015	.008	.003
Pumpkin	.010	.058	.003
Rape	.015	.081	.002
Beet pulp	.006	.073	.000
STRAW			
Wheat	.004	.363	.004
Oat	.012	.38	.008
Barley	.007	.412	.006

FEEDING STANDARD

For Heifers in Milk

Coefficients for food of maintenance per cwt., and nutrients required for the production of one pound of milk testing a given per cent. of butter fat.

	Protein	Carbo-hydrates	Ether Extract
For Maintenance	.07	.7	.01
Milk Testing 2.5	.0378	.188	.0130
" " 2.6	.0391	.194	.0134
" " 2.7	.0404	.200	.0139
" " 2.8	.0417	.206	.0143
" " 2.9	.0430	.212	.0148
" " 3.0	.0443	.218	.0152
" " 3.1	.0456	.224	.0157
" " 3.2	.0469	.230	.0161
" " 3.3	.0482	.236	.0166
" " 3.4	.0495	.242	.0170
" " 3.5	.0508	.248	.0175
" " 3.6	.0521	.254	.0179
" " 3.7	.0534	.260	.0184
" " 3.8	.0547	.266	.0188
" " 3.9	.0560	.272	.0193
" " 4.0	.0573	.278	.0197
" " 4.1	.0586	.284	.0202
" " 4.2	.0599	.290	.0206
" " 4.3	.0612	.296	.0211
" " 4.4	.0625	.302	.0215
" " 4.5	.0638	.308	.0220
" " 4.6	.0651	.314	.0224
" " 4.7	.0664	.320	.0229
" " 4.8	.0677	.326	.0233
" " 4.9	.0690	.332	.0238
" " 5.0	.0703	.338	.0242
" " 5.1	.0716	.344	.0247
" " 5.2	.0729	.350	.0251
" " 5.3	.0742	.356	.0256
" " 5.4	.0755	.362	.0260
" " 5.5	.0768	.368	.0265
" " 5.6	.0781	.374	.0269
" " 5.7	.0794	.380	.0274
" " 5.8	.0807	.386	.0278
" " 5.9	.0820	.392	.0283
" " 6.0	.0833	.398	.0287
" " 6.1	.0846	.404	.0292
" " 6.2	.0859	.410	.0296
" " 6.3	.0872	.416	.0301
" " 6.4	.0885	.422	.0305
" " 6.5	.0898	.428	.0310

FEEDING STANDARD

For Mature Cows in Milk

Coefficients for food of maintenance per cwt., and nutrients required for the production of one pound of milk testing a given per cent. of butter fat.

	Protein	Carbo-hydrates	Ether Extract
For Maintenance	.07	.7	.01
Milk Testing 2.5	.0362	.164	.0124
" " 2.6	.0369	.167	.0126
" " 2.7	.0376	.170	.0128
" " 2.8	.0383	.174	.0131
" " 2.9	.0390	.177	.0133
" " 3.0	.0397	.181	.0136
" " 3.1	.0404	.184	.0138
" " 3.2	.0411	.187	.0140
" " 3.3	.0418	.190	.0142
" " 3.4	.0425	.194	.0145
" " 3.5	.0432	.197	.0147
" " 3.6	.0439	.200	.0149
" " 3.7	.0446	.204	.0152
" " 3.8	.0453	.207	.0154
" " 3.9	.0460	.210	.0156
" " 4.0	.0467	.214	.0159
" " 4.1	.0474	.217	.0161
" " 4.2	.0481	.220	.0163
" " 4.3	.0488	.223	.0165
" " 4.4	.0495	.227	.0168
" " 4.5	.0502	.230	.0170
" " 4.6	.0509	.233	.0172
" " 4.7	.0516	.237	.0175
" " 4.8	.0523	.240	.0177
" " 4.9	.0530	.243	.0179
" " 5.0	.0537	.247	.0182
" " 5.1	.0544	.250	.0185
" " 5.2	.0551	.253	.0187
" " 5.3	.0558	.256	.0189
" " 5.4	.0565	.260	.0192
" " 5.5	.0572	.263	.0194
" " 5.6	.0579	.266	.0196
" " 5.7	.0586	.270	.0199
" " 5.8	.0593	.273	.0201
" " 5.9	.0600	.276	.0203
" " 6.0	.0607	.280	.0206
" " 6.1	.0614	.283	.0208
" " 6.2	.0621	.286	.0210
" " 6.3	.0628	.289	.0212
" " 6.4	.0635	.293	.0215
" " 6.5	.0642	.296	.0217

CHAPTER III

HOME-GROWN DAIRY FOODS FOR WINTER USE

GENERALLY speaking, the nearer we can approach to growing all the feeds on the farm the more money we shall make. This is particularly true of the coarse foods, all of which should be grown on the farm. Commercial feeds are expensive; in fact, in the past few years, many of them have been too high priced for the dairyman who wholesales his milk for 2½ to 3 cents per quart to use with profit. Besides growing the corn crop for the silo, there are many crops which can be grown and made into hay, and which are rich in the important nutrient protein, hence will, in a large measure, take the place of fine feeds in balancing the winter ration.

Corn is one of the most important home-grown crops and should be preserved in the silo and form the basis of the winter ration, and may also compose a large part of the summer ration as well, if desired. Some of the reasons why silage should form the basis of the winter ration may be mentioned briefly as follows:

It is succulent, palatable and digestible, and closely resembles the green forage of summer.

It is prepared for use at small cost, the average expense of harvesting and putting it in the silo does not usually exceed 75 cents per ton.

It requires comparatively small space for storage.

It is ready for immediate use and requires but little labor to place it before the animals.

There is but little loss either from decomposition or waste. The amount from both of these sources, in the writer's experience, has not exceeded 5 per cent. The waste from feeding dried corn stover or corn fodder frequently exceeds 25 per cent.

More milk can be produced from corn silage than from dried corn fodder. Experiments have shown that 12 per cent. more milk can be produced from silage than from corn fodder preserved dry; the fodder being taken from the same field in both cases; or, put in another way, corn preserved in the silo is worth $10 more per acre. For these reasons the silo is regarded as almost a necessity in modern dairying. Indian corn is better adapted than any other crop for the silo, and is at present, and is likely to be the main silage crop throughout the country. Combinations of cowpeas and corn make a valuable food, both being sown in the same drill and cut with a corn harvester. Such crops as cowpeas, soy beans and clovers may be preserved in the silo without mixing with other crops, but as a rule the silage from these crops is more acid and has a disagreeable odor.

The following series of experiments by the author will serve to show the value of certain leguminous crops as substitutes for purchased feeds.

Alfalfa hay.—Alfalfa is one of the plants known as nitrogen collectors and is able to draw its nitrogen directly from the air. The roots are covered with nodules which contain countless numbers of bacteria, and it is through these that the plant secures its nitrogen. It is sometimes necessary to supply these

bacteria. This may be done by using soil from an old field or by cultures of bacteria prepared especially for the purpose. Alfalfa and other plants belonging to the legume family are the best for the farmer to grow, as they provide not only a food rich in nitrogen but lay up in the soil large amounts of this expensive fertilizing element for future crops. Alfalfa hay, properly cured, has no superior and is readily eaten by all farm animals. It is not a complete ration in itself, but should be fed with corn fodder silage, roots, or other carbonaceous foods. For the reason that it contains large amounts of protein, it is a valuable substitute for such feeds as wheat bran and cottonseed meal. Special care should be taken in making alfalfa hay—it should be cut in the forenoon and, when well wilted, raked into windrows and put into cocks, where it should remain until cured. If the leaves are allowed to become dry and brittle the most nutritious and valuable part of the hay will be lost. Three to six tons should be secured per acre.

Experiments with alfalfa hay.*—Four cows were in the test, which included a period of 32 days. The "alfalfa hay ration" consisted of 13 pounds of alfalfa hay and 30 pounds of corn silage. The "feed ration" fed in comparison with this was composed of 30 pounds corn silage, 5 pounds mixed hay, 6 pounds wheat bran, and 5 pounds dried brewers' grains. The two rations contained practically the same amount of protein (3.08 and 3.13 pounds, respectively). The nutritive ration was estimated at

*Bull. No. 161, N. J. Exp. Station.

1:5 in the alfalfa hay ration and 1:6.1 in the feed ration. The alfalfa ration was produced entirely on the farm, while over two-thirds of the most expensive nutrient protein in the feed ration was purchased. While about 4 per cent. more milk was produced from the purchased feed ration, the increase was not enough to offset the greater cost of production, hence the alfalfa ration proved the more profitable. The cost of food used to produce 100 pounds of milk and one pound of butter was 55.9 cents and 11.1 cents, respectively, for the alfalfa ration, and 83.9 cents and 16.7 cents for the feed ration. The profit from feeding the home-grown ration (where milk is worth $1 per hundred) exceeded that of the purchased feed ration by about $2 per cow per month, or with a herd of 25 cows the gain would amount to $50. The cows on the home-grown ration also gained 10 pounds more in weight. On the basis of the experiment when mixed hay (timothy and clover) sells for $16 per ton and when wheat bran costs $26 per ton and dried brewers' grains $20 per ton (as was the case when the experiment was made), alfalfa hay is worth $24.52 per ton as a substitute for mixed hay, wheat bran and dried brewers' grains fed in the proportion indicated in the ration.

Experiments with crimson clover hay.—This is another valuable leguminous crop for the dairy farmer and supplies a palatable food that can be substituted for commercial feeds to good advantage. Where it can be successfully grown it is one of the most useful plants, from the standpoint of yield,

composition, cost, and ease with which it is grown. It may be seeded at the rate of 12 to 15 pounds per acre in corn at the last cultivation, or after a crop of potatoes, without interfering with regular rotations. The yield of hay will range from one to three tons per acre. The method of curing should be similar to that described for alfalfa.

A feeding experiment.*—This experiment was conducted with four cows and continued 30 days. The "crimson clover ration" contained 16.4 pounds of crimson clover hay and 30 pounds of corn silage. This was used in comparison with a "purchased feed ration" composed of 30 pounds corn silage, 5 pounds mixed hay, 6 pounds wheat bran, and 5 pounds dried brewers' grains. The two rations supplied practically, the same amount of dry matter and protein and carbohydrates, while the fat was somewhat greater in the feed ration. The nutritive ratio for the crimson clover hay ration was 1:5.7 and for the feed ration 1:6.1. The crimson clover and silage were produced entirely upon the farm, while over two-thirds of the most expensive nutrient protein in the feed ration was purchased. The home-grown ration proved a practical one from the feeder's standpoint. There was a saving of 18.3 cents per hundred in the cost of the production of milk, and 3.73 cents per pound in the cost of producing butter by feeding the home-grown ration. Stated in another form, the gain from feeding this home-grown ration over the purchased feed ration amounted to $1.10 per cow per month. On the basis of this experiment, when

*N. J. Exp. Station Bull. No. 174, by the author.

wheat bran costs $26 per ton, as was the case at the time this experiment was conducted, dried brewers' grains $20 per ton, and mixed hay (timothy and red-top) $16 per ton, and when these feeds are used in the proportion indicated in the ration, crimson clover hay is worth $16.55 per ton as a substitute for the above feeds.

Crimson clover hay and cowpea silage experiment.—This experiment was similar to the one just described in respect to the number of cows used and the length of time covered by the test. The purpose was to compare the value of a ration that could readily be grown on the farm with a ration in which

Cowpea Silage and Crimson Clover Ration

	Dry Matter	Total Nutrients			Estimated Nutritive Ratio
		Protein	Fat	Carbohydrates	
	Lbs.	Lbs.	Lbs.	Lbs.	
33 lbs. Cowpea Silage	6.01	.99	.46	3.85	.....
10 lbs. Crimson Clover Hay	8.89	1.53	.22	6.38	.....
6 lbs. Corn-and-Cob Meal	5.09	.51	.21	4.28	.....
Total	19.99	3.03	.89	14.51	1:6
Feed Ration					
36 lbs. Corn Silage	9.01	.69	.47	7.48	.....
5 lbs. Mixed Hay	4.47	.31	.13	3.77	.....
4 lbs. Dried Brewers' Grains	3.66	.97	.29	2.31	.....
2.5 lbs. Cotton-seed Meal	2.30	1.05	.32	.74	.....
Total	19.44	3.02	1.21	14.30	1:6

the protein was largely purchased in the form of feeds commonly used by dairymen, namely, dried brewers' grains and cottonseed meal.

It was planned to have each ration contain the same amount of total protein, the amount of milk obtained, other things being equal, being the measure of the relative value of the protein in the two rations. A comparison of the rations shows that they contained practically the same amount of dry matter and protein, namely, 19.99 pounds and 3.03 pounds, respectively, in the silage and clover ration, and 19.44 pounds and 3.02 pounds in the feed ration. The nutritive ratio was calculated and found to be 1:6 in each ration.

During the first period Lot I. was fed the silage and clover ration, and at the beginning of the second period this lot was changed to the feed ration. Lot II. was fed during the first period on the feed ration and during the second period on the silage and clover ration. The object of the changes was to equalize the effect of advance in the period of lactation.

The results showed that the amount of milk and butter produced from the two rations was practically the same. The home-grown ration producing 1,485.1 pounds of milk and 65.89 pounds of butter fat, and the feed ration 1,473 pounds of milk and 68.97 pounds of butter fat, a difference of 12.1 pounds of milk in favor of the home-grown ration. These results show that it was practical, in this instance, from the feeder's standpoint, to grow the entire ration upon the farm.

In calculating the cost, the foods grown on the farm, with the exception of silage, were placed at the market price, namely, $12 per ton for crimson clover hay, $16 for mixed hay, and $17.10 per ton for corn-and-cob meal. The corn and cowpea silage were placed at the cost of production, $3 per ton. The cost of the purchased feeds was $20 per ton for dried brewers' grains and $30 per ton for cottonseed meal. The cost of foods used to produce 100 pounds of milk and one pound of butter from the two rations was 66.9 cents and 15.1 cents, respectively, for the crimson clover hay and cowpea silage ration, and 66.9 cents and 14.9 cents for the feed ration.

While it is shown that practically the same amount of milk and butter was produced from the two rations, and at nearly the same cost, it should be noted that the mixed hay, crimson clover hay and corn-and-cob meal were produced on the farm and charged up in the ration at market prices. There was, therefore, a considerable gain from feeding the home-grown ration, inasmuch as there was a wide margin between the actual cost of these foods and the market price.

For example, the crimson clover hay was grown in corn as a catch crop, costing $4 per ton, hence in selling it to the dairy for $12 per ton (the price used in calculating the cost of the ration), there was a gain of $8 per ton. There was also a considerable profit over the cost of production for the mixed hay and corn-and-cob meal, which were sold to the dairy for $16 and $17.10 per ton, respectively.

These data are significant in showing not only the

value of such home-grown crops as cowpea silage and crimson clover, but that a ration may be produced on the farm that is equally good as a milk producer as one in which the fine feeds are purchased.

The weights of the cows remained practically the same during the feeding of both rations.

Cowpea hay.*—We have in cowpea hay one of the cheapest and most productive crops for dairy animals. "The feeding value of cowpea hay is fully equal to that of the best of red clover and is almost equal to alfalfa, and as much forage can be produced from cowpeas in 80 days as red clover will yield in 15 months." (Grantham.)

More real feeding value will usually be secured when the crop is preserved as hay rather than silage. The crop is cured similar to alfalfa. After it is well wilted it should be put up in cocks not too great in diameter and allowed to remain two or three days until cured, then hauled to the barn without further handling.

Experiment in substituting cowpea hay for purchased feeds.—A ration consisting of 17 pounds of cowpea hay (l. p. 27) and 36 pounds of corn silage was compared with a ration made up of 5 pounds of corn stalks, 36 pounds of corn silage, 4 pounds of wheat bran, 3 pounds of dried brewers' grains and 2 pounds of cottonseed meal. The cowpea hay ration contained 3.06 pounds of protein and had an estimated nutritive ratio of 1 : 6. The feed ration contained 3.20 pounds of protein and had an esti-

*N. J. Exp. Station Bull. No. 174, by the author.

mated nutritive ratio of 1:5. The cowpea ration was produced entirely on the farm, while two-thirds of the protein of the feed ration was purchased. On the cowpea hay ration the daily yield averaged 23.7 pounds of milk, containing 3.86 per cent. of fat; on the feed ration it was 25.7 pounds of milk containing 4.11 per cent. of fat. The feed ration produced 8.3 per cent. more milk, or 15.2 per cent. more butter, than the cowpea ration. At market prices for feeding stuffs the cost of producing 100 pounds of milk was 39.8 cents, and of producing one pound of butter 8.82 cents, when the cowpea hay ration was fed. When, however, the feed ration was given the cost of production was 60.5 cents per hundred for milk and 12.6 cents per pound for butter. With milk at $1 per hundred these results indicated an increased profit for a herd of 30 cows of $37.20 per month from the home-grown ration over the feed ration. However, it is believed that a combination of coarse and fine feeds is necessary to produce the best results.

Soy bean silage and alfalfa hay.—The soy bean is a plant similar to the cowpea but grows a little slower, has a tougher stalk, and is not quite as palatable or quite as sure a crop. However, good yields are secured when conditions are favorable, and the crop is worthy of mention as a home-grown food and a possible substitute for expensive purchased feeds.

Experiment with soy bean silage and alfalfa hay.—A home-grown ration consisting of 36 pounds of soy bean silage, 8 pounds of alfalfa hay,

and 6 pounds of corn meal. The protein content of the ration was 3.64 pounds and the estimated nutritive ration was 1 : 5. The feed ration consisted of 6 pounds of corn stalks, 36 pounds of corn silage, 4 pounds of wheat bran, 4 pounds of dried brewers' grains, and 2 pounds of cottonseed meal. The protein content was 3.45 pounds and the estimated nutritive ratio was 1 : 6. The average daily yield of the milk per cow was 27.2 pounds testing 3.2 per cent. of fat on the home-grown ration, and 25.7 pounds testing 3.8 per cent. of fat on the purchased ration. The home-grown ration produced, therefore, 5.81 per cent. more milk than the purchased ration. The butter production was practically the same on both rations. On the home-grown ration the food cost of 100 pounds of milk was 56.5 cents and of one pound of butter was 13.5 cents, and on the purchased ration 65 and 14.6 cents, respectively, showing a considerable saving when the home-grown feeding stuffs were used.

Another experiment showed that when protein was supplied in the form of cottonseed meal, rather than wheat bran and dried brewers' grains, the saving in cost of production was 11.9 cents per 100 pounds of milk and 3.3 cents per pound of butter.

Advantages of home-grown coarse foods.—It should be noted that the coarse foods mentioned in the above experiments included hay made from alfalfa, crimson clover, and cowpeas, also silage from soy beans and cowpeas were produced on the farm and charged in the rations at market prices. There was, therefore, considerable gain in feeding the

home-grown rations not mentioned above, inasmuch as there was a wide margin between the actual cost of these foods and the market price. For example, the crimson clover hay was grown in the corn as a catch crop, costing $4 per ton, hence in selling it to the dairy for $12 per ton (the price used in calculating the cost of the ration) there was a gain of $8 per ton. An average stand of crimson clover will yield two tons of hay per acre, which at $8 would make the gain per acre 200 per cent. over the cost. The gain per acre for alfalfa hay was even greater, amounting to 38.62 when sold to the dairy for $14 per ton, the price used in calculating the cost of the alfalfa ration. While it will usually pay most dairymen, and pay them well, to purchase some fine feeds in the form of cottonseed meal and other concentrates, the fact cannot be too strongly emphasized that it pays to grow a large proportion of the ration on the farm, and that this practice results in reducing the cost of milk and butter production.

Illustrating how losses in dairying may be due to purchasing expensive feeds.—One dairyman was found complaining that dairying did not pay, although he had fairly good cows and fed an abundance of good food. On examining his conditions it was shown that during the month of January he milked 33 cows yielding an average of 2 gallons of milk daily, which sold for 17½ cents per gallon. His daily ration consisted of 10 pounds mixed hay, 15 pounds corn stover, 35 pounds corn silage, 2 pounds wheat bran, 2 pounds buffalo gluten, 3 pounds corn bran, 2 pounds cottonseed meal, 2 pounds beet pulp,

and 4 pounds molasses grains. The total ration cost 36.5 cents, or 1.5 cents more than the receipts for the milk. He was, therefore, not only milking and feeding his cows for nothing, but losing 50 cents a day besides. All the food except the silage was purchased, when a large part of it might have been raised. The amount of grain fed was too heavy and one-fourth of it was probably wasted. On the basis of the food used during the month indicated, the cost of feed for each cow was $133.22 a year.

The above is quite a contrast from the following which is quoted from Hoard.

"The total cost of keeping a cow in my herd the past year is as follows:

Pasturage	$5.00
6 pounds of grain a day for 210 days at $20 per ton	12.60
10 pounds alfalfa hay a day at $10 per ton	10.50
6,300 pounds ensilage at $1 per ton	3.15
Hay and ensilage used in summer	3.00
	$34.25

"On this sort of feed with good care the herd averaged in 1906, per cow, creamery basis, $76.27, with the addition of $16.20 for skim milk; making a total of $92.47 at the pail. From this subtract cost of food and we have $58.22 profit at the pail above cost of food. Understand I have reduced everything to the creamery basis. Understand another thing, that the cows were good. It would be a reproach to me as a farmer to keep any other. I cannot afford to fool away my time and labor and food on poor cows. I must have the best cows I can produce to make this feed and labor answer back with the highest profit from it. The herd averaged nearly 400 pounds

of butter per cow, including heifers and all. I have no more business to put costly food into a wasteful machine than I have to thresh wheat with a machine that would send half the grain into a straw pile. It has paid me well to think hard, read and study on these things. Is there any reason on earth why it will not pay you to do the same thing?"

Illustrating the value of considering the cost in selecting dairy foods.—The value of carefully selecting a ration, from the standpoint of economy, is very clearly illustrated in an experiment at the Ohio

Average Daily Rations

Lbs.	Feed	Dry Matter. Lbs.	Protein. Lbs.	Crude Fiber. Lbs.	Nitrogen-free Extract. Lbs.	Ether Extract. Lbs
	I—SILAGE RATION					
58.	Silage	10.83	1.369	2.71	5.43	.531
6.8	Mixed Hay	5.77	0.550	1.90	2.761	.211
2.	Oil Meal	1.80	0.664	0.19	0.768	.06
2	Bran	1.76	0.308	0.18	1.078	.08
	Total	20.16	2.891	4.98	10.037	.882
	II—GRAIN RATION					
4.7	Stover	3.29	0.211	1.15	1.70	.063
6.4	Mixed Hay	5.43	0.518	1.79	2.60	.198
2.5	Oil Meal	2.25	0.83	0.237	0.96	.075
5.	Corn Meal	4.25	0.46	0.095	3.435	.19
6.	Bran	5.29	0.924	0.54	3.234	.24
	Total	20.51	2.943	3.812	11.929	.766

State station. Two rations were compounded having practically the same composition, yet differing very materially in cost. These were fed to two lots of cows of five each, for a period of four months, and the results carefully tabulated.

Aside from the standpoint of economy, another object of this test was to determine whether silage could be made to take the place of a considerable portion of the grain usually fed to dairy cows. The silage used was a mixture of one ton of soy beans and cow peas to two and one-half tons of silage corn. The two rations, as shown above, contained about the same amount of nutrients. The cost of the silage ration, however, averaged 13.48 cents daily,

Dry Matter Consumed per Day

In silage ration	20.16 lbs.
In grain ration	20.51 lbs.

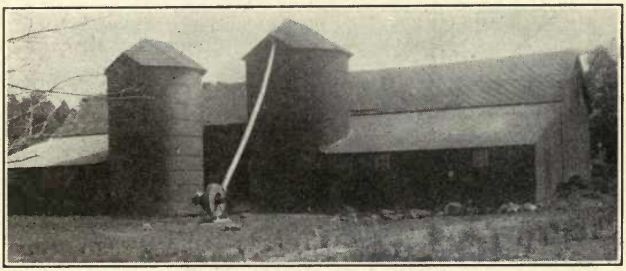
Product per Hundred Pounds of Dry Matter

RATION	Milk Lbs.	Fat Lbs.
Silage	96.7	5.08
Grain	81.3	3.90

Cost of Feed per Unit of Product

RATION	Per 100 Lbs. Milk	Per 1 Lb. Fat
Silage	$0.687	$0.131
Grain	1.055	0.221

while the feed ration cost 17.73 cents. The average monthly yield of milk amounted, in the silage ration, to 588.7 pounds per cow, and the feed ration to



THE DAIRYMAN'S BEST INVESTMENT—THE SILO

503.8 pounds. The profit over feed amounted, in the silage ration, to $5.86 per cow, monthly, and in the feed ration to $2.46.

Putting the results in another form, the following tabulation shows the product per hundred pounds of dry matter.

A difference of 37 cents in the cost of 100 pounds of milk, or a saving of 9 cents in the cost of a pound of butter, is well worth considering. This illustrates very pointedly the results of good business methods in feeding.

ILLUSTRATING THE LOSSES FROM FEEDING POOR RATIONS*

While progressive dairymen know the importance of good feeding, yet the rations used by many show

*Bull. No. 137, N. J. Exp. Station, by the author.

that too little attention is given to this part of their business. The total nutrients supplied are generally sufficient, but the rations frequently contain an excess of the heat and fat-forming elements, i.e., carbohydrates and fat, and too little protein, the nutrient very essential in the production of milk. As no other food compound can take the place of protein and perform its functions, its deficiency must necessarily result in decreasing the milk production. The food-stuffs which are ordinarily grown on the farm are poor in protein, which doubtless accounts in part for the deficiency of this compound in farmers' rations. If a farmer can afford to produce milk at all, he will generally find it profitable to buy feeds containing a high percentage of protein, in order in the preparation of rations to properly balance the home-grown products.

An experiment was conducted to show the advantages of good feeding in the production of milk

GOOD RATION	Dry Matter	Digestible			Nutritive Ratio
		Protein	Fat	Carbohydrates	
	Lbs.	Lbs.	Lbs.	Lbs.	
30 lbs. Silage	7.69	.37	.21	4.48	.....
5 lbs. Hay (Timothy)	4.22	.17	.06	2.23	.....
4 lbs. Wheat Bran	3.53	.54	.13	1.80	.....
4 lbs. Dried Brewers' Grains	3.65	.67	.22	1.36	.....
2 lbs. Linseed Meal	1.82	.50	.14	.69	.....
Total	20.91	2.34	.76	10.56	1:5.3
POOR RATION					
12 lbs. Cornstalks	10.78	.41	.11	6.50	.....
8 lbs. Hay (Timothy)	6.75	.27	.10	3.57	.....
4 lbs. Corn Meal	3.42	.32	.12	2.63	.....
Total	20.95	100	.33	12.70	1:13.5

and butter. Four cows were included in the test, which continued for two months. Two were fed for the first 30 days on the "good ration" and the other two on the "poor ration," then the rations were reversed in order to equalize the effect advance of lactation.

It will be observed that the total dry matter as well as the total digestible nutrients were practically the same in both rations, but a study of the separate food compounds shows that the protein and fat in the poor ration were less than half the amount contained in the good ration, with an excess of carbohydrates, thus making the nutritive ratio extremely wide. The feeding of rations similar in character to the poor one is quite common in many dairy sections.

THE YIELD OF MILK AND FAT

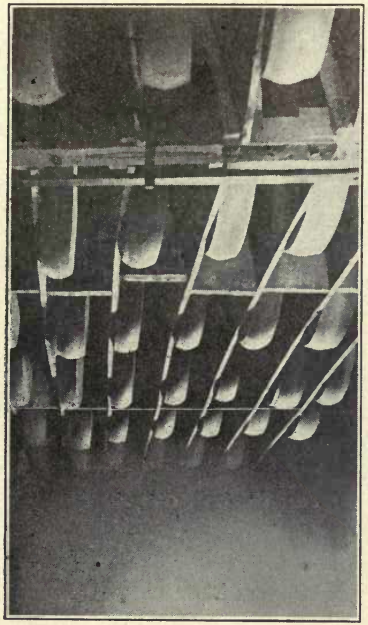
The milk from each cow was weighed daily, and sampled and analyzed for percentage of butter fat. The following table shows the daily yields of milk and its composition as well as the total yield per cow of milk and of fat during each period of the test:

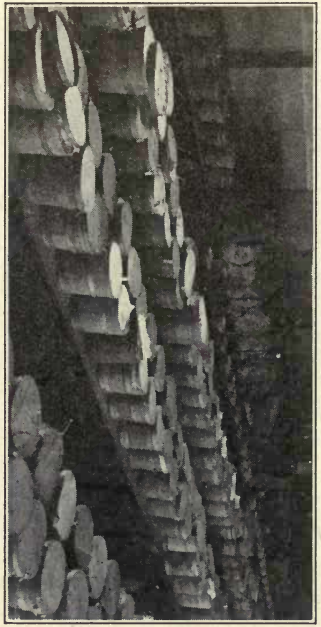
Summary of Test

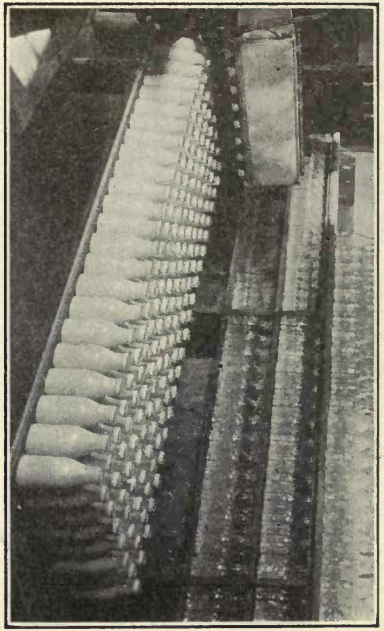
	Good Ration				Poor Ration			
	Milk	Fat	Fat	Butter	Milk	Fat	Fat	Butter
	Lbs.	P. c.	Lbs.	Lbs.	Lbs.	P. c.	Lbs.	Lbs.
Cow No. 1.....	949.9	4.72	44.84	52.31	613.6	4.02	24.68	28.79
Cow No. 2.....	538.5	3.55	19.00	22.28	435.6	3.45	15.01	17.51
Cow No. 3.....	500.4	4.48	22.39	26.12	402.5	4.61	18.56	21.65
Cow No. 4.....	712.9	3.65	25.98	30.31	562.5	4.01	22.58	26.35
Total and average....	2,701.7	4.16	112.32	131.04	2,014.2	4.01	80.84	94.32

This summary shows that 687.5 pounds, or 34.1 per cent., more milk, and 31.47 pounds, or 38.9 per cent., more fat were produced from the good ration than from the poor ration, an actual gain in production of over one-third.

The cost of the food used to produce 100 pounds of milk and 1 pound of butter was practically the same for the two rations, viz., 70.2 cents and 14.5 cents, respectively, for the good ration, and 70.3 cents and 15 cents for the poor ration, yet 34.1 per cent. more milk and 38.9 per cent. more butter were produced from the good ration than from the poor ration with practically the same amount of labor and capital. The results, therefore, indicate that 20 cows well fed, yet with no attempt at forcing, would produce as much milk as 30 cows, equally as good, fed an abundance of corn stalks and timothy hay and 4 pounds of corn meal per day. If, then, there is any profit in producing milk from a ration made up largely of roughage of a carbonaceous character, on the basis of this experiment, the profit might be increased one-third by feeding a ration containing a larger amount of concentrated feed and properly balanced in respect to food compounds. It has been claimed that, other things being equal, a small herd well fed will prove more profitable than a large herd poorly fed, and the facts brought out by this study emphasize the correctness of this claim, and point to the importance of good feeding, in the economical production of milk and butter.







PART V—PRODUCTS

CHAPTER I

YIELD OF MILK AND COST OF PRODUCTION

ACCORDING to the United States census taken in 1900, the average yield of milk per cow was 3,646 pounds, and butter 155 pounds. This amount is too low to afford the dairymen much profit. The records indicate, further, that many dairymen whose herds are below the average in production must be keeping cows at a loss. As a matter of business, then, and a condition essential to best results, every dairyman should study the individuality of his cows, set a standard and maintain it by promptly disposing of the animals which fail to attain it, unless he has reason to believe that the animal will make a better record in the future.

When the standard is reached, it should be gradually but persistently raised. This can be done by keeping a sufficient record of the quantity and quality of the milk product, knowing approximately the cost of production, and systematically weeding out the herd. Six thousand pounds of 4 per cent. milk per cow is a paying yield in most localities, and many grade herds average much higher than this.

WHAT IT COSTS TO PRODUCE MILK

At the New Jersey agricultural college farm the writer kept records of a herd of about 40 cows for 7 years, beginning April 1, 1896. These records include the cost of labor, the kind, amount and cost of foods eaten by the dairy herd and the amount of milk produced by each cow. The cost for the year ending April 1, 1903, is here reported. The herd averaged 34 cows.

The Kind, Amount and Cost of Foods for Thirty-four Cows for One Year, April 1, 1902, to April 1, 1903

	Amount Fed Lbs.	Cost per Ton	Total	
Wheat bran	26,000	$20 40	$265 20	
Dried grains	35,500	18 90	335 48	
Buckwheat middlings	1,500	14 00	10 50	
Wheat middlings	3,000	20 00	30 00	
Rice meal	4,500	20 00	45 00	
Gluten meal	3,000	24 25	36 37	
Cottonseed meal	5,400	29 00	78 30	
Hominy meal	3,000	24 00	36 00	
Cost of feeds				$836 85
Soiling crops	360,000	$1 60	$288 00	
Silage	234,000	2 40	280 80	
Dried cornstalks	20,000	4 00	40 00	
Mixed hay	16,000	5 00	40 00	
Roughage				648 80
Total cost of food				$1,485 65

Total cost of food	$1,485 65	
Cost per cow per day		11.97 cents
Cost of feeds	836 85	
Cost per cow per day		6.74 cents
Cost of roughage	648 80	
Cost per cow per day		5.23 cents
Total yield of milk	98,574	quarts
Average per cow per day	7.94	"
Cost of food per quart		1.51 cents
Cost of feed per quart		.85 "
Cost of roughage per quart		.66 "

The cost of feeds represents what was actually paid. The cost of hay, corn stalks and soiling crops represents the actual cost of labor, seed, manures, and fertilizers, the farm manures being charged at the rate of $1.50 per ton. Fifteen of the 19 forage acres received manure at the rate of eight tons per acre.

The average cost of the daily ration was 11.97 cents, of which 6.74 cents, or 56.3 per cent., is represented by purchased feeds and 5.23 or 43.7 per cent. by the cost of farm crops. The total cost of producing milk, including the cost of labor and the interest on and decrease in the value of the herd, is given, the latter item being estimated.

Foods, as per statement		$1,485 65
Labor	$600 00	
Interest on value herd at 5 per cent.	68 00	
Decrease in value herd at 5 per cent.	68 00	
		736 00
Total		$2,221 65
Cost of food per quart of milk		1.51 cents
Cost of labor and interest per quart of milk		.75 cents
Total cost per quart		2.26 cents

The average weight per quart of milk as put up in bottles for delivery was 2.18 pounds, hence the total weight of milk, 214,891 pounds, was equivalent to 98,574 quarts. The cost per hundred was, therefore, $1.03. At $1 per hundred, the price received in many rural districts, the profits from the business, if any, must be found in the manure. In the calculation of the cost of farm foods the manure was charged at the rate of $1.50 per ton. The amount produced by the herd during the year was 370 tons.

In selling milk for $1 per hundred, the receipts are $72.74 less than the expense. Deducting this amount from the actual charges made for manure, in the growing of the crops—$1.50 per ton—there remains $482.26, which represents the profits from 34 cows, an amount too small to make the business pay. In rural districts, however, where pasture is abundant, the cost of feed would not be as great as where soiling crops supply the entire ration, with the exception of concentrates.

At 3½ cents per quart, the price that would have been received at wholesale, the receipts would have amounted to $3,450.09. Deducting the cost of purchased feeds, labor and interest and decrease in the value of the herd, amounting to $1,572.85, we have a balance of $1,877.24, which represents the value of the home-grown crops; or, in other words, at 3½ cents per quart for milk, the farm would sell its produce to the dairy at profitable prices, namely, $4.62 per ton for soiling crops, $6.94 for silage, $14.45 for hay and $11.56 for dried corn stover, a gain over cost of production of $3.02 per ton for soiling crops, $4.54 for silage, $9.45 for hay and $7.56 for dried corn stover, besides an additional gain represented by 370 tons of manure.

Looking at the question of profit from another standpoint, we will assume that the dairyman performs the work himself. Deducting, therefore, the item of labor, which amounted to $600, from the total cost of production ($2,221.65), we have a balance of $1,621.65. Dividing this amount by the total pounds of milk produced (214,891), we find the cost

per hundred to be 75½ cents. The difference, therefore, between the cost and selling price of the milk represents the dairyman's profits when he performs the work himself.

Assuming that the milk produced by the above 34 cows had been sold for $1 per hundred, a profit of 24½ cents would have been realized from every hundred pounds, or a total of $526.48 for the year's production, besides the additional gain represented by the 370 tons of manure. At 3½ cents per quart, the profits would have amounted to $1,818.44, besides the additional gain from the manure—a good salary for a dairyman.

The average production per year for the 7 years is shown to be 181,345 pounds, equivalent to 83,186

Average Cost of Producing Milk for Seven Years

Year	Number of cows	Milk Produced		Average Yield per Cow	Cost per Cow per Day			Cost per Quart of Milk of—			
		Pounds	Quarts		Feeds	Roughage	Total	Feeds	Roughage	Labor and Interest	Total
					Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts
1896	23	141,517	64,916	6,153	4.99	6.61	11.60	.646	.855	.99	2.
1897	25	154,758	70,990	6,791	5.06	6.38	11.44	.650	.820	.92	2.
1898	25	172,726	79,232	6,911	6.53	6.16	12.69	.750	.710	.82	2.
1899	30	198,345	90,984	6,612	6.65	6.58	13.23	.800	.790	.79	2.
1900	30	195,875	89,851	6,529	7.30	5.35	12.65	.890	.650	.80	2.
1901	30	191,304	87,754	6,377	7.62	5.26	12.88	.950	.660	.82	2.
1902	34	214,891	98,574	6,320	6.74	5.23	11.97	.850	.660	.75	2.
Average....	....	181,345	83,186	6,528	6.41	5.94	12.35	.791	.735	.84	2.

quarts. The average yield per cow was 6,528 pounds. The average cost of food per cow per day was 12.35 cents, of which 6.41 cents, or 51.9 per cent., represents purchased feeds and 5.94 cents, or 48.1 per cent., farm crops. The average cost per quart of milk for the 7 years, including food, labor and interest and decrease in the value of the herd, is shown to be 2.37 cents.

While the care and feeding of dairy cows is of very great importance, the proper selection of animals for the dairy is most essential to success. We must first have a cow capable of good dairy performance before we can secure results. An illustration will serve to make this clear. The accompanying table, taken from Bulletin 29 of the Storrs Agricultural Experiment Station, shows the cost of keep, income and net profit of the station herd each year for 5 years. Particular attention is called to column 12, which shows for a period of 5 years the average net profit of each cow in the herd, or the reward of management. From 1899 to 1903 the average total cost of keeping a cow increased from $92.86 to $94.34, or $1.49, while the income increased from $91.63 to $106.04 and the net profit per cow from $1.23 loss to $21.69 profit.

The author states that "during the five years covered by these records the variety and amount of food and the care of the herd have been much the same. The increase in the net profits from $1.23 loss in 1899 to $21.64 profit in 1903 must be attributed to the selection of animals better suited to dairy purposes. The average cost of animals added to the

AVERAGE NET PROFIT PER COW FOR FIVE YEARS

1	2	3	4	5	6	7	8	9	10	11	12
Year	No. of Records	Cost of Labor, Shelter, etc.	Interest on Value of Cow Minus or Plus Appreciation or Depreciation	Food Cost	Total Cost	Value of Fat	Value of Skim Milk	Value of Manure	Value of Calf	Total Income	Net Profit
1899	20	$33 00	$4 65	$55 21	$92 86	$66 97	$9 82	$12 59	$2 25	$91 63	**$1 23 ***
1900	25	33 00	3 67	53 87	90 54	74 62	11 03	12 49	.3 72	101 86	**11 32**
1901	21	33 00	4 67	47 79	85 46	76 94	11 15	11 03	3 69	102 81	**17 35**
1902	20	33 00	3 65	54 06	90 71	80 59	10 89	11 85	4 22	107 55	**16 84**
1903	17	33 00	4 25	57 10	94 35	85 83	12 24	12 85	5 12	116 04	**21 69**
—	103	$33 00	$4 16	$53 46	$90 62	$76 62	$10 99	$12 15	$3 75	$103 51	**$12 89**

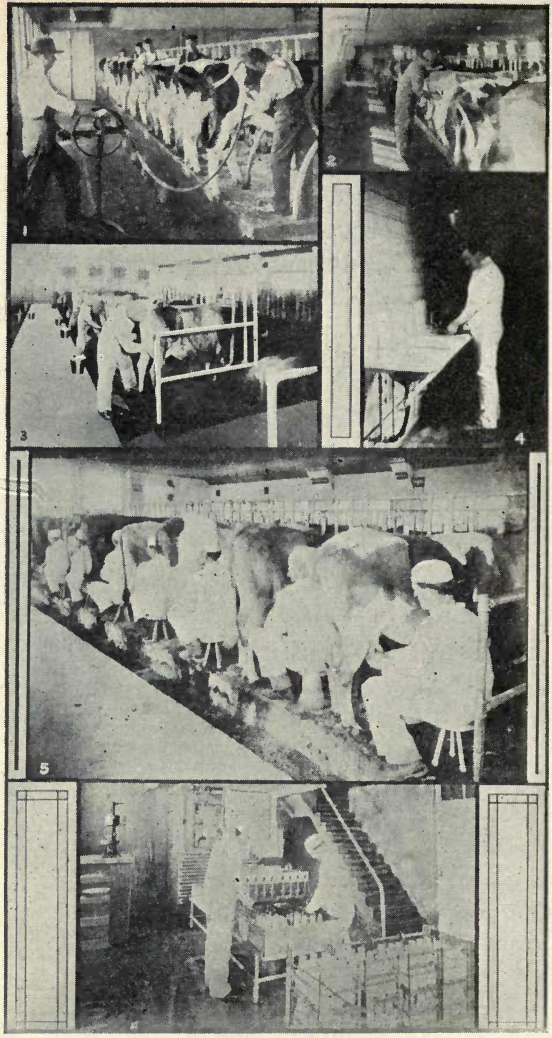
* Loss.

herd since 1899 is $42.50. What change in the system of feeding or caring for the herd would have resulted in as large an increase in net profits? There is no reason why the results secured from this herd cannot be secured by the average farmer. It brings us back again to the importance of using the scales and Babcock test in determining the unprofitable animals and then disposing of them as soon as discovered.

CHAPTER II

SANITARY METHODS IN MILK PRODUCTION

Cows. In order to produce clean milk, cows must be carded daily and kept absolutely free from loose hair and dirt. If the udder and flanks are clipped this will assist very materially in keeping the animals clean. For the safety of the milk, and for the dairyman's profit as well, all cows should be tuberculin tested once a year and reacting animals removed from the herd. No dairyman can afford to keep diseased cows. Such diseases as garget should be treated promptly, and if persistent, the animals should be disposed of. These diseases contribute pus cells to the milk and render it unfit for consumption. Feed clean, healthy foods and such as will not contribute an undesirable flavor to the milk. The water supply for the cows should be clean, fresh, and protected from possible contamination.



STEPS IN THE PRODUCTION OF CLEAN MILK

1. CLIPPING COWS
2. BRUSHING COWS
3. WASHING UDDERS
4. WASHING HANDS BEFORE MILKING
5. MILKING
6. BOTTLING MILK

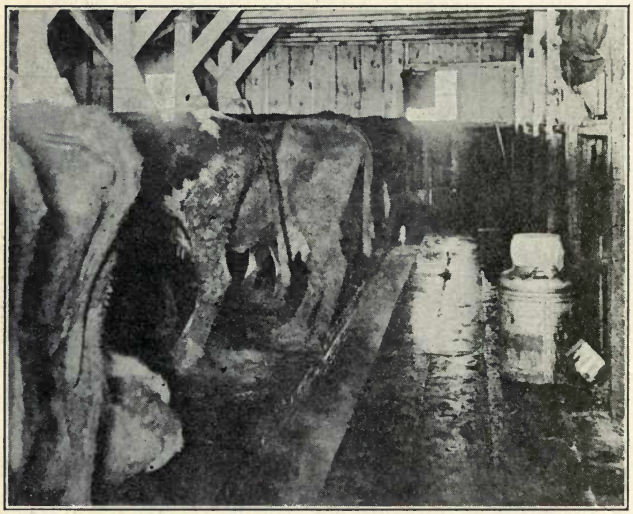
(Continued on p 173)

FROM BULLETIN NO. 104, B. A. I., DEPARTMENT OF AGRICULTURE, BY THE AUTHOR

7. SEALING BOTTLES
8. STORAGE
9. CASE OF MILK READY FOR DELIVERY
10. DELIVERY WAGON
11. WASHING BOTTLES
12. STERILIZING BOTTLES

FROM BULLETIN NO. 104, B. A. I., DEPARTMENT OF AGRICULTURE, BY THE AUTHOR

Stables. The stables should be located at a safe distance from the pig pen, privy or other source of contamination. The best material for the floor is cement, considering its cheapness, its sanitary qualities, and its permanency. Some object to animals standing on a cement floor, but where an abun-



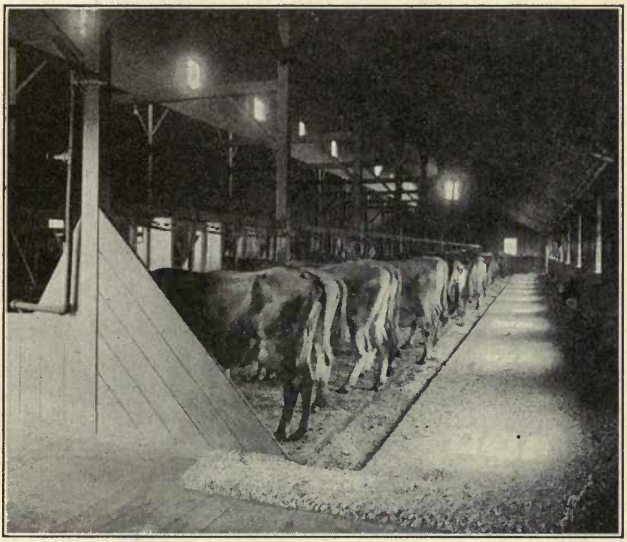
FILTHY STABLE AND FILTHY COWS, SHOWING ALSO THE TOO COMMON PRACTICE OF STRAINING THE MILK IN THE STABLE

dance of bedding is provided no serious troubles result. However, if a dairyman prefers a tight plank floor, kept in repair, this is good enough.

Dirt floors, or floors constructed of loose stone or brick, permitting the liquid manure to leach through, are not sanitary and should be avoided.

I do not care what kind of a tie the dairyman has,

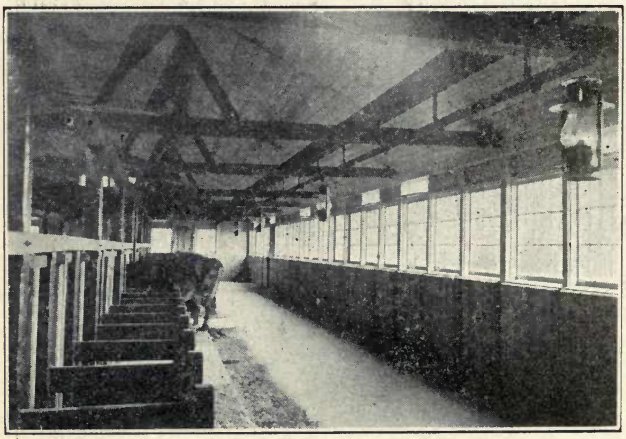
provided it is comfortable. Some form of the swing stanchion, however, is desirable, as it keeps the animals in place and keeps them cleaner. Rigid stanchions should be avoided. A low down manger is desirable, as it permits of circulation of air and easy cleaning. This should be constructed of cement



CLEAN COWS AND CLEAN STABLE

also. A box stall should be provided for isolating sick animals and for use of cows at calving time. Make the side walls and ceiling tight and smooth and keep them whitewashed or painted. Care should be taken in constructing the stable to have as few corners and dust-catching ledges as possible. See

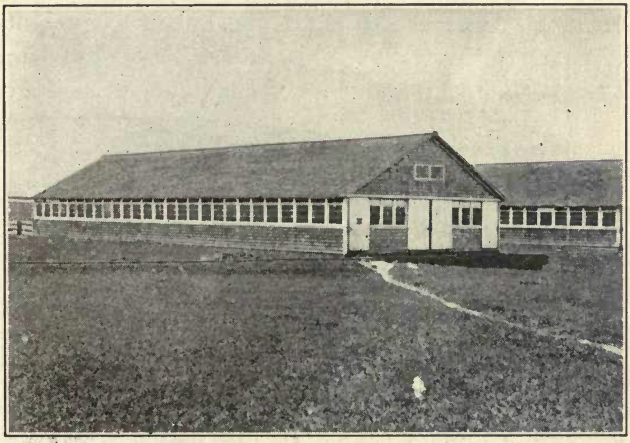
that the entire stable is kept clean and free from cobwebs. Four square feet of glass should be provided for each cow, distributed as evenly as possible throughout the stable. While the best system of ventilation is still a somewhat mooted question, whatever system is adopted, care should be taken to see that it is effective. The King system, if properly



INTERIOR OF A WELL-LIGHTED STABLE

constructed, will do the work. The muslin curtain system, now being used on many dairy farms, is the cheapest and appears to be fairly satisfactory. It permits of constant circulation of air, removes all moisture, and even when the outside temperature is several degrees below zero the air in the barn is not uncomfortable. Two square feet of muslin placed in the stable in a similar position to the windows, are allowed for each cow. Care should be taken that the

proper grade of muslin (not canvas) is used. Two grades better than cheese-cloth has given the best



A MODERN STABLE, ADMITTING AN ABUNDANCE OF LIGHT

VENTILATING BY MEANS OF THE MUSLIN CURTAIN

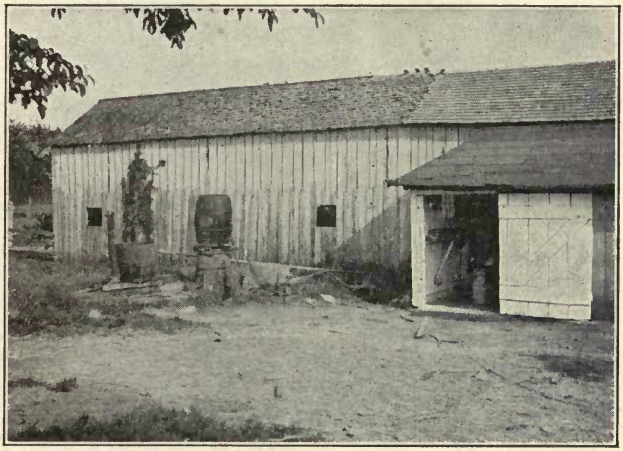
results. Many claim to secure efficient ventilation by means of adjustable windows, but this is not automatic and requires constant attention for good results. At least 500 cubic feet of air space is desirable for each cow, even where there is a good system of ventilation. No other animals should be

MANURE BREEDS FLIES AND CONTAMINATES THE MILK

housed in the same stable with the cows. Haul the manure to the field daily, or to a protected, watertight pit outside the barnyard and at a sufficient distance to prevent odors from reaching the stable. Keep the stable yard clean and well drained.

Milk house.—Preferably this should be a separate building and located at a safe distance from all sources of contamination. Abundance of light and some system of ventilation should be provided. It should be equipped for heating water or generating

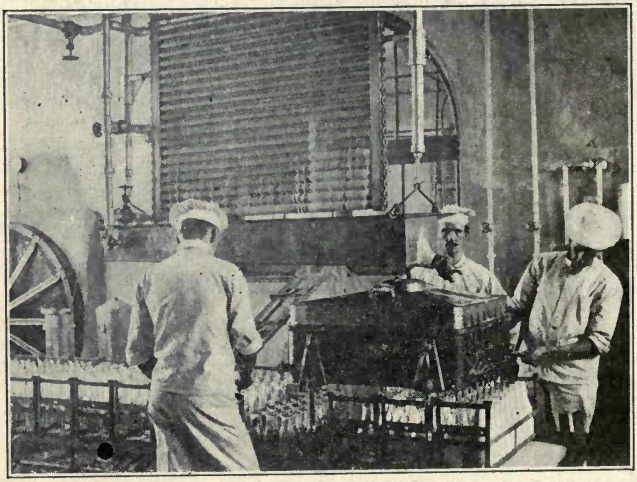
steam. It should also be supplied with a cooler, proper pails, cans and strainers, and storage facilities. It is desirable that the milk house be divided into two sections, one for heating water and cleaning utensils and the other for cooling and storing the milk. We are considering now the dairyman



MILK HOUSE CONNECTED WITH THE STABLE—A BAD PRACTICE

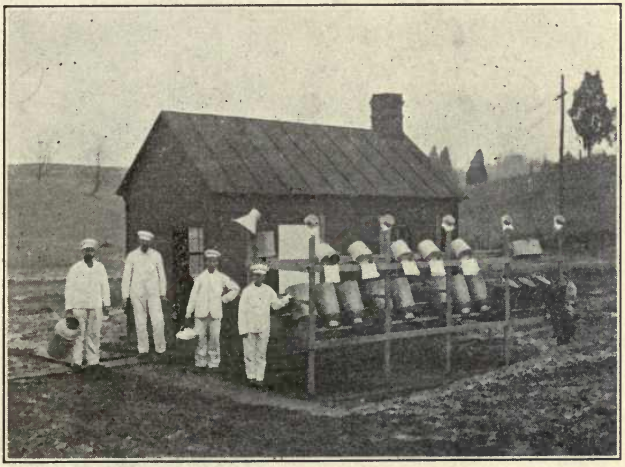
who produces market milk rather than the butter maker. The floor of the milk house should be constructed of cement and the walls and ceiling made smooth and tight for ease in cleaning. Provide screens for doors and windows. It is particularly important that the water-supply for cleaning should be free from all contamination. Any contagious disease can be readily transmitted through this medium, as the milk comes in direct contact with the

BOTTLING MILK



INTERIOR OF A MODERN DAIRY HOUSE

utensils. Improper cleaning of utensils is often the cause of sour milk. Soaking first in lukewarm water, thoroughly washing in boiling water containing some cleaning material, rinsing in clean hot water and careful draining will generally secure cleanliness. It is better still, however, to go a step farther



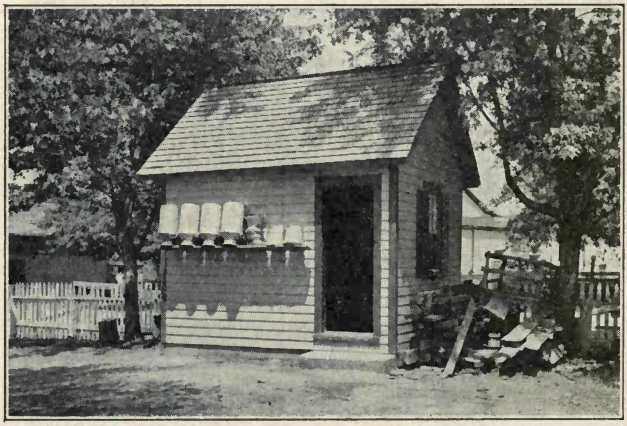
A CHEAP BUT PRACTICAL MILK HOUSE. UTENSILS PROPERLY CARED FOR

and sterilize all utensils with steam. Pails, cans, strainers, etc., should be inverted in pure air, if possible in the sunlight, on suitable racks.

Milking.—It goes without saying that the milker should be healthy. He should wear a clean garment, wipe the udder and surrounding parts with a clean moist cloth and milk with clean, dry hands. It is desirable to use a small-top milk pail to prevent

contamination of the milk during milking as far as possible.

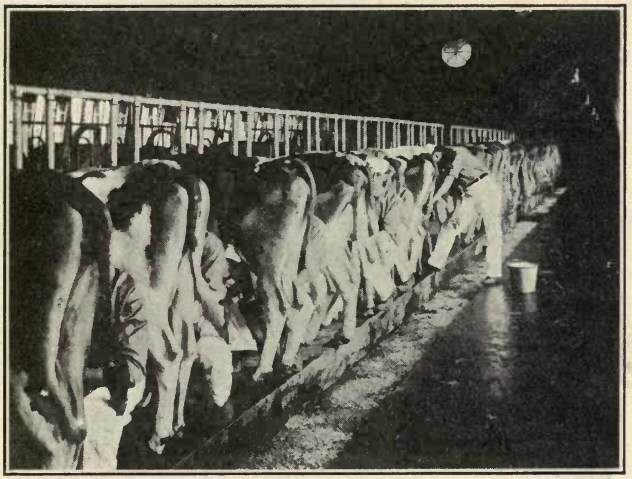
Cooling and storing.—The best plan is to remove the milk from the barn after milking each cow, strain, and run over a cooler, immediately reducing the temperature to at least 50° It is just as impor-



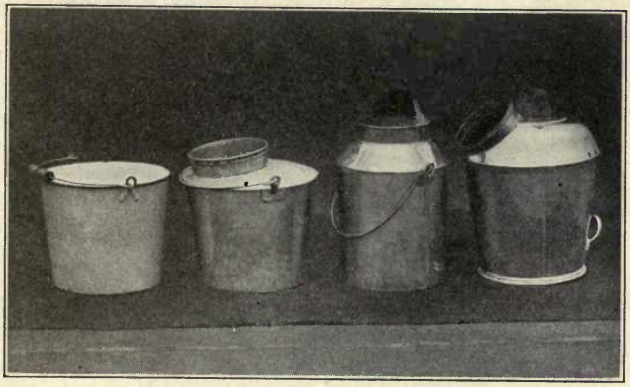
A MILK HOUSE FOR THE SMALL FARMER

tant, also, that the milk be stored at a low temperature. Ice is the best protection during transportation, but the milk should at least be protected with a wet blanket in summer and a dry one in winter.

The dairy score card.—The score card presented herewith is used by the Dairy Division, United States Department of Agriculture, for rating dairy farms. It points out ideal conditions and shows mathematically the proper weight to be given to each division of dairy work. Any dairyman can



INTERIOR OF CLEAN STABLE



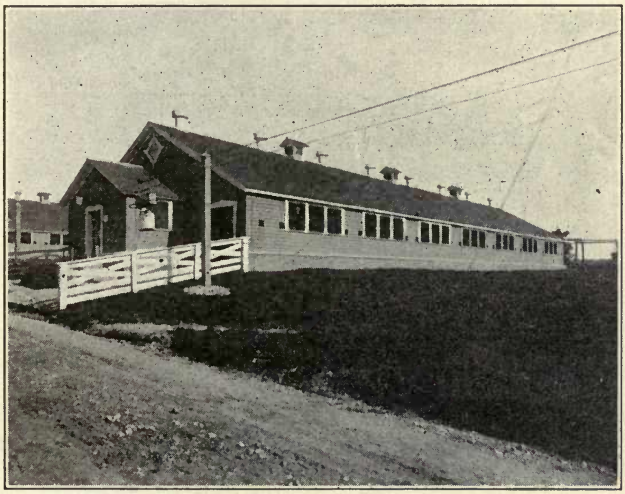
FOUR STYLES OF MILK PAILS. THE TWO AT THE RIGHT KEEP OUT NEARLY ALL DUST AND DIRT
(Published in Bul. No. 41. Hygienic Laboratory, Treasury Dept.)

readily score his own dairy by carefully following the instructions accompanying the card and determine how far he has progressed in the production of clean milk. The Boards of Health in a number of the larger cities have adopted this card as a basis for issuing permits to dairymen and for keeping records in a concise form of the conditions existing on the

DIRTY MILK DEPOSITS A SEDIMENT IN THE BOTTOM OF THE BOTTLE

various farms which supply the city with milk. Some cities not only adopt a standard which every dairyman must reach, but publish in their regular reports the standing of every dairy. It will be readily seen, therefore, where this is the practice, that it is to the producer's advantage to have a creditable rating. In some instances a higher price

is paid for milk from the best dairies, resulting in greater profits, while the dairy with a low score is obliged to sell its product for 1 to 2 cents per quart less. The point desired to emphasize here is that it will be to the dairyman's advantage to use modern methods in the production of milk, to secure the en-



TROLLEY SYSTEM FOR CONVEYING MILK FROM THE STABLE TO THE MILK HOUSE

dorsement of the city health officer in the form of a good rating on the score card mentioned, and having done this he is in a position to make this fact known to his customers and use it as an aid in building up his business.

It will often pay him to go still farther than this and have his herd examined physically by a compe-

tent veterinarian, and tuberculin tested. He can then use the veterinarian's endorsement of the health of his herd in addition to that of the health officer (which shows the sanitary conditions), and thus be in a position to sell milk of the highest quality.

SANITARY INSPECTION OF DAIRIES

DAIRY SCORE CARD

Owner or lessee of farm .....

Town ..... State .....

Total No. of cows ..... No. milking .....

Quarts of milk produced daily ..... Product is sold at wholesale retail. Name and address of dealer to whom shipped .....

Permit No. ..... Date of inspection ....., 190

Score of methods ..... multiplied by 2 = ...

Score of equipment ..... multiplied by 1 = ...

Total ....divided by 3 =

_____ Final score

REMARKS .....

.....

.....

.....

.....

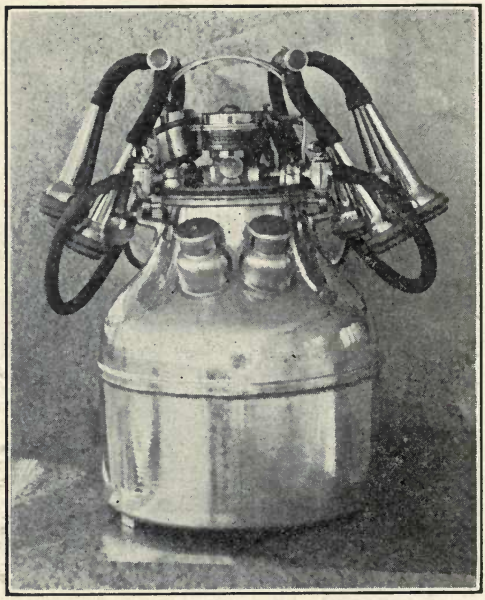
(Signed)

.....

Inspector

DETAILED SCORE

EQUIPMENT	Score		METHODS	Score	
	Perfect	*Allowed*		*Perfect*	*Allowed*
COWS					
Condition	4	.....	Cleanliness of cows	10	.....
Health (outward appearance)	6	.....			
Comfort	4	.....	Cleanliness of stable	12	.....
Bedding 2			Floor 4		
Temperature of stable 1			Walls 3		
Protected yard 1			Ceiling 2		
Cubic feet of space per cow: Over 300, 2; over 400, 4; 500 to 1,000, 6	6	.....	Ledges 1 Mangers and partitions 1 Windows 1		
Feed	4	.....			
Water	8	.....	Stable air	4	.....
Clean 6					
Fresh 2			Removal of manure	4	.....
STABLE			To field or proper pit 4 30 feet from stable 2		
Location	6	.....			
Well drained 3			Cleanliness of stable yard	2	.....
Free from contaminating surroundings 3					
Construction	10	.....	Cleanliness of milk room	6	.....
Tight, sound floor 3			Care and cleanliness of utensils	10	.....
Gutter 1			Inverted in pure air 2		
Stall, stanchion, tie 1			Clean (sterilized) 8		
Low-down manger 1					
Smooth, tight walls 1			Cleanliness in milking	14	.....
Smooth, tight ceiling 2			Clean, dry hands 4		
Box stall 1			Udders washed and dried 10		
Light: 1 sq. ft. glass per cow, 2; 2 sq. ft., 4; 3 sq. ft., 6; 4 sq. ft., 8; even distribution, 2	10	.....	Cleaned with moist cloth 8 Cleaned with dry cloth 4		
Ventilation: Sliding windows, 2; hinged at bottom, 4; King system or muslin curtain, 8	8	.....	Cooling	20	.....
Stable yard (drainage)	2	.....	Cooled immediately after milking each cow 10		
			Cooled to 50° F. or below 10		
MILK ROOM			51° to 55° F 8		
Location	6	.....	56° to 60° F 6		
Convenience 2					
Free from contaminating surroundings 4			Storing	8	.....
Construction	4	.....	Below 50° F 8		
Floor 1.5			51° to 55° F 6		
Walls and ceilings 1			56° to 60° F 4		
Light .5					
Ventilation .5			Transportation	10	.....
Screens .5			Iced 10		
Arrangement	2	.....	Jacket or wet blanket 8		
Equipment	6	.....	Dry blanket 4		
Hot water or steam 2			Covered wagon 2		
Cooler 2					
Narrow-top milk pail 1					
Other utensils 1					
Water supply for utensils	10	.....			
Clean 6					
Convenient 2					
Abundant 2					
Clean milking suits	4	.....			
Total	100	.....	Total	100	.....



THE BURRELL-LAWRENCE-KENNEDY MILKING MACHINE

MILKING MACHINES

One of the most practical pieces of apparatus that have recently been perfected for the use of the dairy farmer is the milking machine. It is particularly welcomed at this time when labor is becoming scarce or incompetent. The wages paid for labor have also increased very materially during recent years. Many farmers have become discouraged, owing to these conditions, and either given up the dairy business altogether or greatly reduced the

size of their herds. The innovation of the milking machine has tended to reverse these conditions, and the small dairyman is now increasing his herd, and the dairyman who went out of business has returned to it with greater energy than ever. It is reported that there are 3,000 of the Burrell-Lawrence-Ken-

THE BURRELL-LAWRENCE-KENNEDY MILKING MACHINE IN OPERATION

nedy machines alone, which are probably milking daily 25,000 to 30,000 cows. A description of this machine follows.

THE BURRELL-LAWRENCE-KENNEDY MILKING MACHINE

With this machine the milk is drawn by intermittent suction. The suction may be created by either a vacuum pump or a steam ejector. Connected

with the vacuum pump is a vacuum reservoir and a pipe running the whole length of the cow stable, with a connection valve or vacuum cock between each pair of cows. A safety valve is connected to the reservoir to prevent the vacuum from running higher than is desired.

The machine itself (page 188) consists of a heavy tin pail, which is cone-shaped and holds about 55 pounds of milk. The cover of this pail is a disk, in which is a vacuum motor which produces the pulsations in drawing the milk from the teats. The cover fits the pail tightly and excludes all air.

To operate the machine it is placed between the pair of cows to be milked. A rubber tube connects the pail top or pulsator with the vacuum cock above the stanchions. On opening the cock the air is drawn from the pail and the motor immediately starts. The degree of pressure maintained is about one-half atmosphere, or 7½ pounds to the square inch. Leading from the pail cover or pulsator are two flexible tubes besides the one leading to the vacuum cock above the stanchions. At the end of each tube are 4 cups, which are fitted over the teats of the cow. The milk from the 2 cows is discharged into one pail (page 189). In operation the machine makes a low, clicking sound, which is caused by the motor. The vacuum pulsations run from 50 to 70 per minute and may be easily adjusted to the speed required. The milk in passing from the cow to the pail goes through a glass inspection tube, so that the operator may watch the flow. When the milk ceases to flow the suction is turned off and the action of the ma-

chine stops. Four different sizes of teat cups are provided, so that different sizes of teats may be fitted.

Cost of equipment for machine milking.—At the present time the equipment required to milk a herd of 40 cows with the machines and the cost of the same would be as follows:

1.	An engine or some power with which to drive the machine. For milking up to 8 cows at a time, a 2-horsepower gasoline engine may be used, costing	$105 00
2.	A vacuum pump, costing	75 00
3.	A vacuum tank, like a tank that is used in connection with ranges or stoves in kitchens, costing	11 00
4.	The piping with valves, etc., necessary in barn, depending upon extent of plant, number of cows, etc., costing for a 42-cow dairy about	25 00
5.	Four milking machines, costing	300 00
	Total	516 00

One machine milks 2 cows at a time, and it has been found practicable to allow one machine to every 10 or 12 cows when equipping the herd.

In a general way it may be said that the entire cost of installing a plant for herds of different sizes would be about as follows:

For a dairy of 30 cows, with 2 machines, milking 2 cows each or 4 cows at one time, cost per cow	$13 00
For a dairy of 40 cows, with 3 machines, milking 6 cows at one time, cost per cow	12 00
For a dairy of 60 cows, with 4 machines, milking 8 cows at one time, cost per cow	10 00
For a dairy of 75 cows, with 5 machines, milking 10 cows at one time, cost per cow	8 50
For a dairy of 100 cows, with 8 machines, milking 16 cows at one time, requiring about a 4-horsepower engine and a larger pump, cost per cow	10 00

One good careful man or woman can operate 4 machines milking 8 cows simultaneously, and an additional hand cannot only carry away the milk, but assist in manipulating the cows' udders. The operating expense of the machines is comparatively small.

Different kinds of power which may be utilized.—The kind of power employed to operate cow milkers is not important provided it is uniform and can be depended upon.

Dairymen well know that, in the case of hand milking, if they were to stop for a time when a cow was partially milked and then begin again and finish milking, the chances are that there would not only be a decrease in yield, but the milk would be of poorer quality. A similar effect is produced in the case of machine milking. If the engine, or whatever power is employed to work the pumps, stops for any cause during the milking, a marked decrease in the yield of milk results.

Gasoline engines.—These are most commonly employed for power at the present time.

Electric motors.—Some farmers located near cities find electricity the most convenient power. This has worked successfully on two farms at least. In one case a trolley line passes near the barn and a wire is attached to the main trolley wire and connected with a one horsepower electric motor inside of the building. As electric roads are now being rapidly built through country districts, it is quite possible that this may prove a popular method of securing power to operate cow milkers.

Steam power.—Steam engines are employed on some farms, and they will be found to work satisfactorily in supplying power to operate the milking machines. Where steam is used on farms for other purposes it can be made to run the milkers with but little extra expense.

The milking machine described has many advantages, one of the most important being the saving of labor, as less than one-half the help is required. It is necessary that the labor employed, however, be of a little higher class, and better wages must be paid, as the milking machine, like other farm machinery, requires intelligent operators to secure the best results. One man can readily operate 3 or 4 machines and milk from 25 to 30 cows an hour. Two men with 6 machines can milk 60 cows an hour. It will be readily seen that even one man can milk a fair sized herd, thus making it possible for the other helpers to start with the teams early in the morning and work them the full day without having to stop to do dairy work. With the milking machine the dairyman can take charge of a good sized herd without assistance, if he so desires, and is then independent of labor difficulties. Experiments thus far conducted show that in some instances more milk is secured through the use of the machines and in others less. It is believed, however, that where the machines are properly handled fully as good results may be obtained with machine milking and with much less labor. It should be stated that the machine has some objections and difficulties. The outlay at the beginning may prove a serious obstacle to

dairymen of limited means. Others who are financially able to make the investment will hesitate in installing machines until their practical utility has been fully demonstrated. Another drawback is the time required to properly clean the machines. Unless properly cleaned, more bacteria may be introduced into the milk than by hand milking, and souring take place quicker. However, with proper facilities for cleaning the results should be better than by the old method.

Other machines.*—There are several other machines that have been on the market for a shorter time and their practical value has not yet been demonstrated. No machine will prove practical which cannot be sterilized in all its parts and is not adapted to the use of the ordinary dairyman.

CHAPTER III

WINTER DAIRYING TOO MUCH NEGLECTED

It is the practice with many dairymen to milk their cows in summer and let them go dry in winter. They seem to think that winter is the time for the cows to "rest," and themselves as well. Many, also, make the claim that feed-stuffs are too expensive. This is all wrong. With the silo as an aid, milk can be produced on thousands of our farms as cheap in winter as in summer, and prices for this product are

*See Bulletin No. 92, B. A. I., Dept. of Agriculture.

very much higher in winter. With all-the-year-round dairying, too, the hired help is kept continuously employed and there is more time to devote to the care and feeding of the herd, there are no flies to annoy the animals and the food supply can be depended upon. Considering all these points we see that winter dairying has many advantages over summer feeding. Go to the creameries through the country and look up the patrons who supply a uniform quantity of milk month after month through the year and you will find that it is the all-the-year-round dairyman that has the biggest checks and is the most prosperous.

The principal reason for failures in winter dairying is lack of business methods. To illustrate: A farmer let his cows run out in the corn field in cold bleak weather and the stable was not much warmer than the open fields. When asked why he did not build a warm stable he said that lumber was too expensive and the price of milk too low. Yet this same farmer drove two miles every day with 20 quarts of milk, and could give no reasonable excuse for doing so. This man had enough cows on his farm, and had he taken good care of them and fed them properly he could have delivered 100 to 125 quarts of milk daily. He was feeding 12 to 14 cows and they were all dry with the exception of three, and they were strippers. This, too, was in the middle of December, when the milk shippers were bidding $1.40 per hundred weight at the railroad station where the farmers delivered their milk. He had no milk to deliver at the time when milk should

bring a profitable price. His cows were fresh on grass and stayed fresh for perhaps six months, when the price of milk was lowest. Then when winter came his cows were poorly housed, given poor feed and practically no attention. What this man needed was better business methods rather than a higher price for his product.

Second illustration: The following description of methods practiced by another dairyman in the same State is directly opposite from the above, and shows good business methods. This man had been shipping for several years practically as much milk in December as when his cows were on grass. He fed his cows plenty of good milk-producing feeds with the belief that in order to get good results out of them he had to feed results into them. He was a dairyman every month in the year. He was shipping eight to nine cans (8 gallon) of milk per day, from 22 cows, and his milk check for the month of December was $316. He was feeding a ration of hominy feed and dried brewers' grains, with shredded corn fodder and clover hay for roughage, and was giving them all they would eat up clean with a relish.


FAIRFIELD
DAIRY

PART VI—SALES

CHAPTER I

BUSINESS METHODS IN RETAILING MILK

THE problems and difficulties which attend the retailing of milk are numerous, and yet if the work is conducted on a strictly business basis the retailer will, as a rule, secure his share of the profits.

Handling the milk.—At the present time the glass bottle is the best style of package for use in delivering milk. While it has some disadvantage over the so-called dippage system, such as extra weight on the wagon, extra work of cleaning, and breakage and loss of bottles (which amounts to about 10 cents a day for each 100 used), the decrease in waste and better sanitary condition of the milk when delivered (experiments have shown that milk dipped in city streets contains three times as many bacteria as the same milk handled in bottles) more than offsets the extra cost. There is good prospect in the near future for a still better package for use in delivery of milk in the paper pulp milk bottle. The advantages of such a bottle are very evident, as it is simply used once and thrown away. The principal saving will be in the lighter weight on the delivery wagon and in the expense of handling

and washing the thousands of bottles which require so much labor and expensive equipment in our milk plants at the present time. Several styles have already been manufactured and appear to be practical; the only questions remaining to be solved appear to be the cost of the bottle and the attitude of the consumer to this innovation.

Losses due to waste in handling.—It has been my experience that the profits are affected in no small degree by the attention given to the loss of milk during the processes of cooling and bottling, and particularly in delivery where the dippage method is practised. Hence the importance of having a careful man to do this work. The following tabulation illustrates this. About 250 quarts were handled daily.

	Waste in Handling, Cooling and Bottling. Per Cent.	Waste in Delivery or Dippage. Per Cent.	Total Waste. Per Cent.
1897	5.7	5.1	10.8
1898	4.4	4.9	9.3
1899	4.8	2.0	6.0
1900	4.7	1.7	6.4
1901	3.8	1.7	5.5
1902	.8	1.2	2.0
1903	—	.16	.16

During the years 1897 and 1898 about 50 per cent. of the milk was bottled, so that the actual loss due to dippage was practically 10 per cent. of the amount handled in cans. For the last five years the proportion of milk delivered in bottles was gradually increased—in fact, from July 1, 1902, practically all of the milk was delivered in bottles. The waste in delivery and dippage the last year amounted to practically nothing more than an occasional broken

bottle. The tabulation also shows that there was a decrease from year to year in the percentage of waste in handling, cooling and bottling. This is due largely to improved apparatus and greater care in handling the product.

CHAPTER II

DAIRY ACCOUNTS—DAILY RECORD

It is important that the dairyman have proper forms for his accounts, not only that he may save time but that he may always have the statements up to date, make out bills regularly, etc. The system used for such records should be simple and plain and show at any time each customer's indebtedness. The following sheet from a driver's account book illustrates a system which has proved practicable for the daily record.

In connection with this daily record, the driver enters on the back of the envelope shown herewith the amount of milk and cream taken, delivered, returned and wasted, the size of package, whether quarts, pints or half-pints, and the total cash received, from credit customers (those who were rendered monthly bills), cash customers and the sale of tickets. He places the cash in the envelope, seals it and turns it over daily to the farm superintendent, who enters the accounts in an ordinary cash book and ledger.

The milk and cream may be checked out to the driver every day or only occasionally to keep tab on his records.

Use of tickets.—Where tickets are used they should be handled but once and destroyed, thus eliminating the danger of carrying disease from one

DRIVER.................................... DRIVER....................................

The New Jersey College Farm Milkmen's Account for the Month of.........190

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
	MILK SERVED																															
J. A. Smith	CREAM SERVED																															
44 Market St.	TICKETS																															
	CASH																															
	MILK SERVED																															
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	CASH																															

family to another. With the style of tickets now in common use, they are handled by all kinds of people, sick or well, kept in dirty kitchen drawers and other insanitary places and become a dangerous source of filth and disease. The expense of printing tickets on cheap paper is very slight. It is convenient to have pads printed containing a dollar's worth each.

THE COLLEGE FARM

REPORT OF MILK SALES AND COLLECTIONS

MADE BY

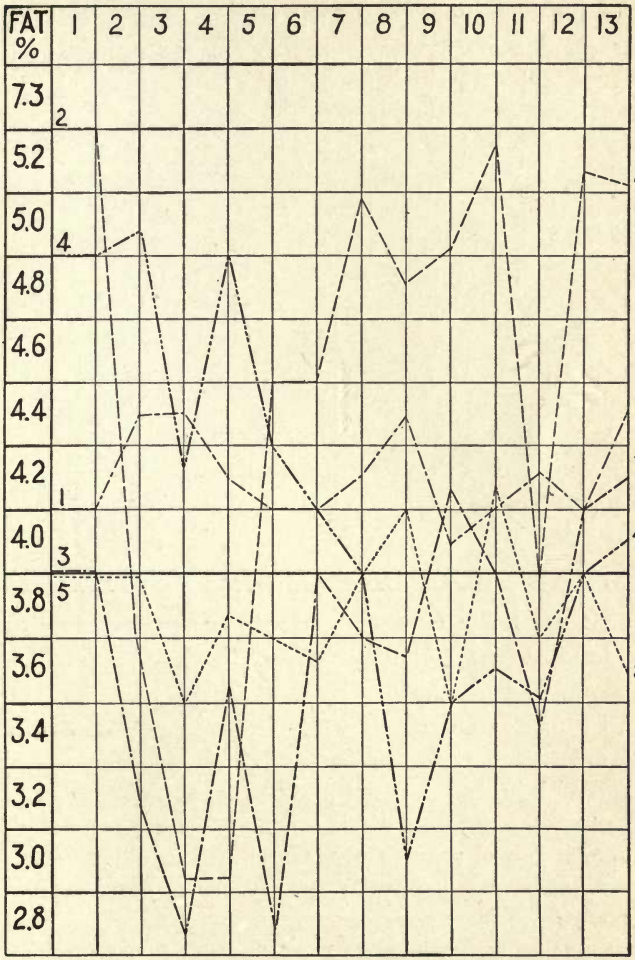
Driver_____

Date_____

	MILK			CREAM		
	Quarts	Pints	Whole-sale	Quarts	Pints	Half Pints
Taken.....						
Returned.....						
Delivered.....						
Waste.....						
Total Delivered.....						
Total as Quarts.....						

	BOTTLES			SKIM MILK
	Quarts	Pints	Half Pints	
Taken.....				Qts. taken _____
Returned.....				Qts. returned _____
Shortage.....				Total,
Gain				

	$	
Cash Customers.....		
Cash Customers—Tickets.....		
Credit Customers.....		
Total.....		



The columns Nos. 1, 2, 3, etc., indicate the weeks during which the experiment was continued, and the column at the left of the diagram shows the per cent. of butter fat for the weeks during which the experiment was conducted. The figures on the right show the number of dealers. No. 1 represents the composition of the milk from a herd in charge of the author during the period of thirteen weeks.

Lack of uniformity in the composition of milk.—Many dairymen make the mistake of selling milk varying greatly in quality from day to day. They do not seem to appreciate the fact that consumers desire and look for a uniform amount of cream, and when they do not find it they accuse the dairyman of some crooked work, which may be simply poor business methods in handling the milk. Many customers change their milkman for no other reason than this, and he is left to wonder why his business does not increase. To illustrate: I had an opportunity to study the variation in the butter fat content in the milk actually delivered to consumers by five retail dealers in a certain city for a period of 13 weeks, the results of which are shown graphically in the accompanying illustration.

WHAT PRODUCT IS MOST PROFITABLE FOR THE DAIRY FARMER?

It is often a problem with the farmer what product he can best afford to sell. That is, will it be more profitable to sell whole milk or can he better afford to sell cream or butter? This, of course, will depend largely upon the price that each product can command. Even with the prices before the dairyman, it is not always easy for him to decide which product will pay him best, as there is some difference in the freight or express charges on the different products, and in case cream is sold, the skim milk is left for feeding purposes, and where butter is sold, the buttermilk has a value for feeding; at

the same time, there is some labor attached to making butter.

The following table has been prepared to aid the dairyman to decide in what form he can best sell the products of his dairy.

PRICES OF MILK, CREAM, BUTTERFAT AND BUTTER COMPARED

MILK		VALUE				
% Fat	Price per Gallon	20% Cream per Gallon	25% Cream per Gallon	30% Cream per Gallon	Butter fat per Lb.	Butter per Lb.
	10	.41	.49	.58	25.5	18.0
	12	.52	.63	.75	32.0	23.5
3.5	14	.63	.76	.92	39.0	29.0
	16	.74	.90	1.00	46.0	35.0
	18	.85	1.04	1.26	53.0	41.0
	20	.96	1.28	1.43	60.0	47.0
	10	.34	.42	.50	23.0	16.0
	12	.44	.54	.65	29.0	21.0
4.0	14	.54	.66	.79	35.0	26.0
	16	.63	.78	.93	41.0	31.0
	18	.73	.90	1.08	47.0	36.0
	20	.83	1.02	1.22	53.0	41.0
	10	.30	.36	.43	21.0	14.0
	12	.39	.47	.56	26.0	18.5
4.5	14	.48	.57	.60	31.0	23.0
	16	.57	.67	.82	36.0	28.0
	18	.66	.77	.95	41.0	33.0
	20	.75	.87	1.08	46.0	38.0
	10	.27	.33	.38	19.0	12.5
	12	.34	.42	.50	24 0	16.5
5.0	14	.43	.52	.62	29.0	20.5
	16	.51	.62	.74	34.0	24.5
	18	.50	.72	.81	39.0	28.5
	20	.67	.82	.98	44.0	32.5

It should be stated in explanation of the above table that milk is taken as the basis for making the comparison in prices. For example, in the second line where milk containing 3.5 per cent. fat sells for 12 cents per gallon, cream containing 20 per cent.

fat should bring 52 cents per gallon; 25 per cent. fat 63 cents, and 30 per cent. fat, 75 cents per gallon.

The creamery should pay 32 cents per pound for butter fat, and butter should sell for 23.5 cents. Values have also been worked out for milk containing 4, 4.5 and 5 per cent. fat, when sold for different prices per gallon. By glancing at this table, the dairyman should be able to tell how he can dispose of his milk most profitably. Minimum and maximum prices ordinarily received for milk at wholesale are given, and if higher or lower prices are received, it will be easy to make computations from the figures presented. In making these computations, skim milk and buttermilk have been valued at 20 cents per hundred. The freight on milk has been figured at 2 cents per gallon and cream 3 cents, as these are the charges commonly made within a radius of 50 miles of the larger cities. No allowance has been made for hauling. As this varies greatly under different conditions, each farmer can best calculate it for himself. There would be but little difference in the charge for hauling to the creamery or shipping station, and where butter is made, the labor will usually be equal to that of hauling the whole milk.

The difference in the amount of fertility sold in milk, cream or butter (see page 18) also has a bearing upon this question of comparative prices.

It will be noticed that dealer No. 2, for instance, delivered milk the first week containing 7.3 per cent. of fat, the second week it dropped to 3.8, and the third week to nearly 3; the fourth week the same as

the third, it increased again the fifth week to 4.6, and continued with similar extreme variations throughout the 13 weeks, as shown in the diagram. Others also showed a similar lack of uniformity. These results indicate either carelessness in preparing milk for delivery, that is, delivery to the consumer; rich milk from certain animals in the herd one day and poor milk from other animals the next, or carelessness in dipping the milk, the first customer receiving milk from the top of the can and the last from the bottom. It is very probable that the uniformity was affected by both these causes, and shows the importance of properly mixing the herd milk, also of delivering milk in bottles, insuring each customer a uniform product from day to day.

Is it possible to have a uniform product? The author's experience with a herd of 25 to 30 milking cows has a bearing upon this subject. The accompanying tabulation gives the average per cent. of fat in the mixed milk from this herd as well as the maximum and minimum of the individual cows, the number of fresh cows introduced into the herd, and the number of cows milking during the month. The fresh cows were introduced when necessary to supply a uniform quantity of milk from day to day rather than for the direct purpose of regulating the composition. Corresponding results may be expected from any similar herd under good conditions of feeding and management. The tabulation shows that the milk of individual animals varied in composition from month to month, but such variation did not materially affect the average composition of

the daily product of the herd, that is, the per cent. of fat in the mixed milk of all the animals was not low one day and high the next.

THE AVERAGE MONTHLY COMPOSITION OF HERD MILK AND THE VARIATION IN THE COMPOSITION OF THAT OF INDIVIDUAL COWS

Month	Average Per Cent. of Fat in Mixed Milk	Minimum Per Cent. of Fat of Individual Cows	Maximum Per Cent. of Fat of Individual Cows	Number of Cows Milking	Number of Fresh Cows Introduced during the Month
May	4.2	3.6	6.3	18	1
June	4.3	3.7	6.5	20	2
July	4.3	3.5	6.1	19	2
August	4.4	3.4	5.9	20	1
September	4.3	2.6	6.8	23	4
October	4.4	2.9	7.4	24	2
November	4.2	2.5	7.6	22	1
December	4.2	2.6	8.3	18	..
January	4.3	2.8	8.0	22	3
February	4.1	3.1	6.6	22	2
March	4.0	3.1	6.6	25	4
April	4.1	3.0	7.1	26	2

It will be observed that although a wide variation exists in the fat content of the milk of individual animals, ranging from 2.6 to 8.3 per cent. in the month of December, the composition of the entire daily product is remarkably uniform—4 per cent. of fat could have been safely guaranteed throughout the year. The lowest, 4 per cent., is found in the month of March, 1897, and the highest, 4.4 per cent., in August and October, 1896, or a range of .4 per cent. between highest and lowest, a difference so slight from month to month as not to materially

affect either the producer or the consumer. In other words, it appears from the study of this herd, which is fairly representative, that so far as uniformity of composition of the daily mixed milk is concerned, its sale on the fat basis would have been entirely practicable.

It was also found that it was not even necessary to mix the milk of the whole herd. With care in arranging the animals in the barn so that the milking might take a certain order, it was possible to furnish from day to day a product that was practically uniform in composition.

Notwithstanding the fact that different animals showed a wide difference in the composition of their product, due to individuality, breed, feed, and period of lactation, it was entirely practicable to furnish a product that did not vary one-half per cent. in the content of butter fat.

THE QUART BASIS OF SELLING MILK UNFAIR TO PRODUCER AND CONSUMER

The value of milk for butter-making depends upon its content of butter fat. The value of this product as market milk also depends upon the amount of butter fat it contains and should be sold on this basis, but is commonly sold on the quart basis. The dairyman, therefore, who is producing milk richer than the average is not receiving his share of profits for the reason that, as a rule, it costs more to produce rich milk than poor milk. To il-

lustrate: One cow in a dairy herd produced 2,000 quarts of milk in one year which contained an average of 6.4 per cent. of fat, while another cow under the same conditions of feed produced the same period 3,200 quarts containing, on the average, 4 per cent. of fat. At 3 cents per quart the value of the product from the first cow was $60, while that from the last named cow was worth $96, or a difference between the two of $36. Any improvements or economy in feeding could not make up for the difference in the returns from the product of these two animals on the quart basis of sale. If, however, the product of the 2,000 quart cow had been sold on the basis of its fat content, or converted into its equivalent of 4 per cent. milk, it would have been worth exactly the same as that of the 3,200 quart cow. This is one instance where the method of sale is more important than making efforts to reduce the cost of production.

To again illustrate the unfairness of the method, farmers who sold milk containing a high per cent. of fat to creameries when the quart basis was practiced, were practically making it possible for their neighbors to make a profit who produced milk containing a low per cent. of fat. The farmer producing rich milk, therefore, although he might have studied closely the cost of production, was unable to realize a profit. When the method was changed and the milk was sold on the fat basis, the rich-milk farmers made a good profit while the others were obliged to obtain better animals or go out of business. A few creameries are still buying milk on the

same old basis. These same considerations apply, in a large measure, to the sale of market milk, because the cost of production per quart is, as a rule, less for that of a low quality than of a high one. It is evident, therefore, that those who produce higher cost products of a better quality are not receiving, on the quart basis, a price proportionate to its value. An investigation of the character of the milk as now sold, made by the New Jersey Experiment Station in 1896, clearly showed the lack of uniformity in the quality of milk offered for sale, and the great injustice of the present method. In this study 108 samples were taken from the delivery wagons of representative dealers in four large cities. The examination showed a range in content of butter fat of from 2.56 to 7.76 per cent., and therefore in selling at a uniform price on the quart basis (this milk all sold for 8 cents), those having the highest grade received less than it was worth and those the lowest more than it was worth. Or, assuming that the low grade was worth the price charged, those having the high grade received but $1 for milk that was actually worth $1.38. The fact was also brought out that if milk containing 4 per cent. of fat is worth 8 cents per quart, milk containing 3.50 would, on the same basis, be worth 7 cents per quart; and 3 per cent. milk only 6 cents per quart, while milk containing 4.50 per cent. fat would be worth 9 cents per quart, and 5 per cent. milk 10 cents per quart. If the fat content were adopted as a basis of sale the consumer would be protected in the sense that he would receive just what he paid for, and the producer

of a high quality product would have the advantage of a higher price, which fairly belongs to him because of the greater cost of producing milk of a better quality. A few dairymen are already practicing this method with success, the percentage of fat in the milk being stamped on the milk cap and the system should be encouraged for the benefit of both producer and consumer.

Lack of uniformity in the sanitary qualities of milk.—It is only until recently that much attention has been given to the sanitary quality of milk. City Boards of Health have given their attention largely to chemical standards for milk, and examinations have been made chiefly for content of fat and total solids and for adulteration and preservatives. At the present time more attention is being given to the sanitary conditions at the farms, to the health of the cows, and to the cleanliness of the milk when delivered to the consumer. Now, in addition to asking the question, "Is the milk reasonably rich and free from adulterations?" the Board of Health asks, "Is the milk clean?"

The standards used for judging milk on the sanitary basis include bacteria (the number allowed ranging, in different cities, from 100,000 to 500,000 per c.c.); temperature of the milk (which is required in some instances to be 50° F. or below when entering the city); and the dairy score card already referred to.

Education of the public.—The grading of milk on the basis of its chemical and sanitary qualities is of little value to the dairyman unless the general pub-

lic demands a good product and is willing to pay for it. Until very recently "milk was milk" whether produced under good or bad conditions, and the cheapest product has generally been sought. The fact has not been appreciated that the price of feeding stuffs and labor have been constantly increasing during the past 10 years, while the price of milk to the consumer has scarcely changed at all. It has been stated elsewhere that it cost more to produce rich milk than poor milk, and it is equally true that it costs more to produce clean milk than dirty milk. There is no use in legislating for the production of a quality of product that the people do not want. There is a general movement throughout the country for cleaner milk and better foods in general. The dairy farmer, then, who practices good business methods and is awake to this situation should put himself in a position to meet the demands for better milk, which is constantly increasing. This is clearly shown in the increased demand for certified milk produced under the supervision of medical milk commissions and which retails at prices ranging from 10 to 20 cents per quart.

CHAPTER III

ADVERTISING

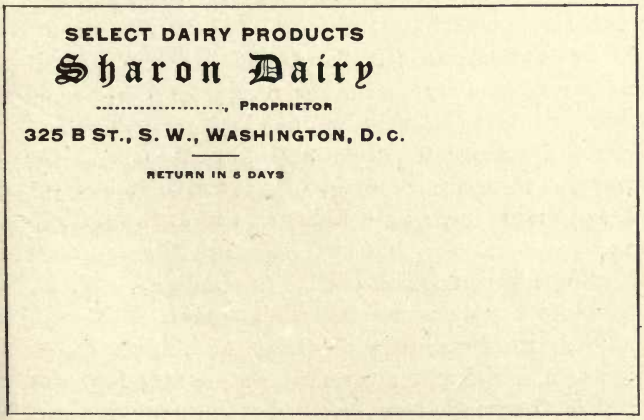
ALL business men learn that judicious advertising pays. The dairyman is no exception and can bring his products to the attention of the public in many ways and with little expense. A few examples are given as follows:

1. **Appearance of the farm.**—Every passer-by unconsciously forms his opinion of the farm management and quality of the products and becomes in himself an advertiser or otherwise. Neat surroundings, buildings well painted and in good repair, farm well laid out and good crops, all help to make a good impression. In this connection the author calls to mind a man who had a good reputation as a dairy farmer and on driving several miles across country to visit him, passing farm after farm poorly cared for, suddenly came in sight of a place which presented a great contrast to those already seen. The farm was well laid out, the crops even and well cultivated, two silos were conspicuous near the stable, and the whole presented a neat, attractive and businesslike appearance. I did not need to be told that this was my destination, as the dairyman lived up to his reputation and the farm was its own advertisement. This contrast was due not to money but to business methods.

2. **Appearance of the dairyman and his team.**—Like the dairy farm, the dairyman and his team should present a neat, businesslike appearance, which will certainly give him an advantage over his careless and slovenly neighbor. While this alone will not insure success, it helps to advertise his business.

3. **Name of the farm.**—It is well for every dairyman to have a name for his farm, which, if used in business transactions, will serve as a trade mark and aid in selling the products. Every effort should be made, therefore, to have the products of the high-

ILLUSTRATING LETTER HEAD ADVERTISING



ILLUSTRATING ENVELOPE ADVERTISING

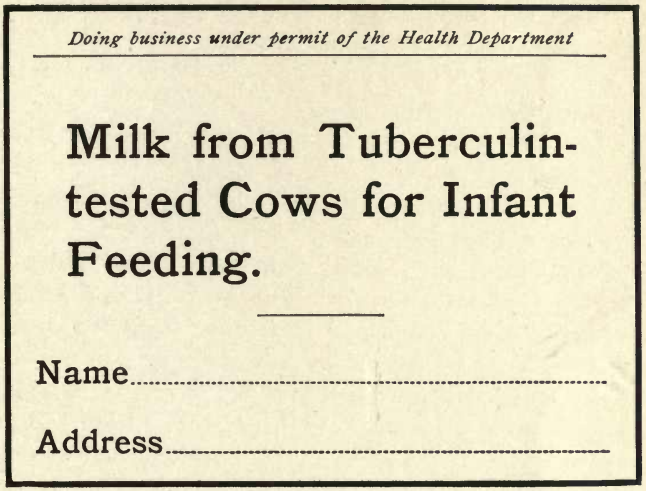
est quality in order that this trade name will carry great weight wherever it goes and will always be identified with the best grade of goods.

4. Letterheads and printed envelopes.—A very inexpensive method of advertising is through printed letterheads and envelopes used in business correspondence. The envelopes may bear the name of the farm, the proprietor and post-office address. Fancy characters are not necessary on the letterheads, a simple, tasty advertisement put up in attractive type is best. The local printer will do this work at surprisingly low cost.

5. Printed circulars.—It often pays to put before prospective customers a single-page circular giving a simple businesslike statement of the products for sale and the prices asked. This is particularly effective where the dairyman makes a specialty of high grade milk or cream or dairy butter.

6. Newspaper advertising.—Where the business is large enough to warrant it, advertising through the newspapers may be made very profitable. This method has the advantage of reaching new customers and a large number of people at once. This is the most expensive form of advertising, but often brings new trade and enlarges the business. Here, as in the circular, if a special point can be made of high grade or special quality of products, it is more likely to attract a prospective customer.

7. A good product the best advertisement.—An instance came under the writer's observation, where a dairy of forty cows changed management. At this time many of the animals were unhealthy, buildings



ILLUSTRATING NEWSPAPER ADVERTISING

in poor repair, stables insanitary, and no dairy house provided for the handling of the milk and sterilizing utensils. The sales of milk from this farm had not increased materially for several years, and the farm was not paying expenses. While a fairly good quality of milk (from a chemical standpoint) was sold, it was not clean. The new manager began his work by removing the unhealthy animals, improving the buildings in a sanitary way and providing a dairy building. These changes, however, were made slowly, as the money had to be earned to provide for the expense. One important improvement in the delivery of milk was the change from the "dippage" system to the use of bottles. No advertising was done aside from supplying good milk, the ground

being taken that a good product should sell itself. The price charged for the milk was the same as in previous years. During the first year, when changes were being made, there was an increase in the sales of but 5 per cent. The following year, when milk that was clean as well as rich was guaranteed, the increase amounted to about 19 per cent., or a total gain to the farm of about $1,000 in the annual income. This was obtained with little other increase in cost than in the extra animals and in the feed, as the labor necessary for handling the milk in production and delivery was the same as that found necessary in the case of the smaller product. In the years which followed, the increase was even more marked, these results being obtained wholly by better business management resulting in a high-grade product.

CHAPTER IV

BUSINESS ACCOUNTS ON A DAIRY FARM

THE importance of keeping separate farm records has already been emphasized, and the business accounts are no less important in the general system. A complicated system of records involving double-entry bookkeeping is not necessary on the average dairy farm, but a simple cash account and a ledger is within the compass of the average farmer and (with an inventory taken once a year) is all that is required.

The specimen pages shown herewith help to make this clear. For the sake of brevity the milk

CASH BOOK

CASH

1907		RECEIVED			1907		PAID OUT		
Jan.	1	To Balance	20	15	Jan.	6	By Shoeing team	2	00
"	8	" Milk sales	25	10	"	15	" Wages of driver	30	00
"	15	" " "	26	17	"	20	" Suit clothes	18	00
"	20	" John Smith	10	00	"	21	" Trip to State Fair	5	00
"	22	" Milk sales	30	15	"	22	" J. Johnson on a/c	15	00
"	23	" Henry Hudson	55	16	"	24	" Disc harrow	20	00
"	24	" 1 Grade calf	15	00	"	25	" 1 bbl. flour	5	25
"	25	" 40 lbs. butter @ .25	10	00	"	26	" 100 lbs. sugar	5	00
"	29	" Milk sales	35	18	"	30	" Deposit 1st Nat. Bank	100	00
					Jan.	31	By Balance	26	66
			226	91				226	91

sales in the accompanying cash account are entered but once a week—the ordinary dairyman would perhaps enter them daily. He should be sure that the cash on hand at the end of any month agrees perfectly with the balance in his cash book.

LEDGER

In the ledger we keep an account with persons. On January 1st, John Smith owed a balance of $10, which he paid January 20th, thus closing his account. At the beginning of the month Henry Hudson owed a balance of $65.16, but on January 23d paid $55.16, leaving a balance January 31st of $10, which is an asset. On January 1st we owed J. Johnson $25, but on January 22d paid him $15 on account, leaving us $10 in his debt—a $10 liability. These are the only forms of accounts which arise in ordinary transactions, and if the fundamental principles are understood the dairyman need have no difficulty in keeping his own business accounts.

INVENTORY

The receipts and expenditures alone do not show the real profits and losses of the business during the year. It is necessary to take an inventory of the property on hand. This should include property of every description. The difference between the assets and the liabilities will give the net value. It is of interest to keep these records year after year, to make comparisons.

LEDGER

JOHN SMITH

1907		Dr.			1907		Cr.		
Jan.	1	To Balance.....	10	00	Jan.	20	By Cash	10	00

HENRY HUDSON

1907		Dr.			1907		Cr.		
Jan.	1	To Balance	65	16	Jan.	23	By Cash	55	16
						31	" Balance.....	10	00
			65	16				65	16

J. JOHNSON

1907		Dr.			1907		Cr.		
Jan.	22	To Cash	15	00	Jan.	1	By Balance.....	25	00
"	31	" Balance	10	00					
			25	00				25	00

ASSETS.

1. Real estate:
    a. Land.
    b. Water supplies.
    c. Growing crops.
    d. Buildings.
2. Live stock.
3. Implements.
4. Farm products.
5. Notes receivable.
6. Stocks, bonds, etc.
7. Personal accounts (owing us).
8. Cash in bank.
9. Cash on hand.

LIABILITIES.

1. Notes payable.
2. Mortgages.
3. Store bills.
4. Personal accounts (we owe).

The inventory may be taken during any month at the convenience of the dairyman, but is most frequently taken at the close of the year, December 31st, when all books are balanced. There are some reasons why other times are more convenient, as, for example, in April or May; the supply of hay in the barn is low, the silos have become empty, and it is easier to estimate the value of such materials at this time. The objection to this date is that the dairy-

man is busy with field work and does not like to take the time to balance his accounts.

To take an inventory properly requires good judgment of farm equipment and values. It is sometimes necessary to consider cost and selling price as well as actual service value to the owner. Due consideration should be given to deterioration of real estate, machinery, and live stock.

APPENDIX

Digestible Nutrients in One Pound of the More Common Feeding Stuffs (Stone)

KIND OF FOOD	Total Dry Matter	Pounds of Digestible Nutrients			Nutritive Ratio
		Protein	Carbohydrates + (fat × 2.25)	Total	
SOILING FODDER					
Fodder Corn	.20	.010	.125	.135	1:12.5
Peas and Oats	.16	.018	.076	.094	1: 4.2
Peas and Barley	.16	.017	.077	.094	1: 4.5
Red Clover	.29	.029	.164	.193	1: 5.6
Alfalfa	.28	.039	.138	.177	1: 3.5
Hungarian Grass	.29	.020	.169	.189	1: 8.4
Corn Silage	.21	.009	.129	.138	1:14.3
ROOTS AND TUBERS					
Potatoes	.21	.009	.165	.174	1:18.3
Beet, Mangel	.09	.011	.056	.067	1: 5.1
Beet, Sugar	.13	.011	.104	.115	1: 9.4
Carrot	.11	.008	.082	.090	1:10.3
Flat Turnip	.10	.010	.077	.087	1: 7.7
HAY AND STRAW					
Timothy	.87	.028	.465	.493	1:16.6
Mixed Grasses and Clover	.87	.062	.460	.522	1: 7.4
Hungarian Hay	.92	.045	.546	.591	1:12.1
Red Clover Hay	.85	.068	.396	.464	1: 5.8
Alfalfa Hay	.92	.110	.423	.533	1: 3.8
Corn Fodder	.58	.025	.373	.398	1:14.9
Corn Stover	.60	.017	.340	.357	1:19.9
Pea-vine Straw	.86	.043	.341	.384	1: 7.9
Bean Straw	.95	.036	.397	.433	1:11.0
Wheat Straw	.90	.004	.372	.376	1:93
Oat Straw	.91	.012	.404	4.16	1:33.6
GRAIN					
Corn (Av.)	.89	.079	.764	.843	1: 9.7
Wheat	.90	.102	.730	.832	1: 7.2
Rye	.88	.099	.700	.499	1: 7.1
Barley	.89	.087	.692	.779	1: 7.9
Oats	.89	.092	.568	.660	1: 6.2
Buckwheat	.87	.077	.533	.610	1: 6.9
Peas	.90	.168	.534	.702	1: 3.2
MILL PRODUCTS					
Corn and Cob Meal	.85	.044	.665	.709	1:15.1
Wheat Bran	.88	.122	.453	.575	1: 3.7
Wheat Middlings	.88	.128	.607	.735	1: 4.7
Dark Feeding Flour	.90	.135	.658	.793	1: 4.9
Low Grade Flour	.88	.082	.647	.729	1: 7.9
Rye Bran	.88	.115	.548	.663	1: 4.8
Buckwheat Bran	.90	.074	.347	.421	1: 4.7
Buckwheat Middlings	.87	.220	.456	.676	1: 2.1

(Continued on page 228)

Digestible Nutrients in One Pound of the More Common Feeding Stuffs (Stone)

(Continued from page 227)

KIND OF FOOD	Total Dry Matter	Pounds of Digestible Nutrients			Nutritive Ratio
		Protein	Carbohydrates + (fat × 2.25)	Total	
RYE PRODUCTS					
Malt Sprouts	.90	.186	.409	.595	1: 2.2
Brewers' Grains (wet)	.24	.039	.125	.164	1: 3.2
Brewers' Grains (dry)	.92	.157	.478	.635	1: 3.0
Gluten Feed	.92	.194	.633	.827	1: 3.3
Gluten Meal	.92	.258	.656	.914	1: 2.5
Hominy Chops	.89	.075	.705	.780	1: 9.4
Linseed Meal (old process)	.91	.293	.485	.778	1: 1.7
Linseed Meal (new process)	.90	.282	.464	.746	1: 1.6
Cotton-seed Meal	.92	.372	.444	.816	1: 1.2
MISCELLANEOUS					
Cabbage	.15	.018	.091	.109	1: 5.1
Sugar Beet Leaves	.12	.017	.051	.068	.....
Sugar Beet Pulp	.10	.006	.073	.079	1:12
Beet Molasses	.79	.091	.595	.686	1: 6.5
Apple Pomace	.233	.011	.164	.175	1:14.9
Skim Milk (gravity)	.096	.031	.065	.096	1: 2.1
Skim Milk (centrifugal)	.094	.029	.059	.088	1: 2.0
Butter Milk	.10	.039	.065	.104	1: 1.7

Elements of Fertility in 1,000 lbs. (Stone)

		No. of Analyses	Water in 1000 lbs.	Ash in 1000 lbs.	Nitrogen in 1000 lbs.	Phosphoric Acid in 1000 lbs.	Potash in 1000 lbs.	Estimated Value per ton
1	Maize Fodder (green)	45	828	14.7	1.6	1.1	3.9	$0.90
2	Peas and Oats (green)	.....	467	16.05	2.8	1.65	6.25	1.50
3	Barley and Peas (green)	.....	755	16.7	2.7	1.8	5.05	1.38
4	Red Clover (green)	42	790	16	4.6	1.5	4.8	1.86
5	Alfalfa (green)	11	760	22.1	6.2	1.5	3.5	2.18
6	Hungarian grass (green)	6	870	12	3.2	.7	4.7	1.38
7	Corn Silage (green)	.....	779	.....	1.4	1.1	3.7	.82
8	Potatoes	197	750	11	1.4	1.6	5.7	1.04
9	Mangle-werzel	.....	873	12.2	1.7	.9	3.8	.90
10	Beets (Sugar)	68	820	8.1	1.7	.8	3.7	.88
11	Carrots	63	870	10	1.2	.9	2.6	.65
12	Timothy Hay	69	143	41.1	4.4	5.0	14.1	2.95

(Continued on page 229)

Elements of Fertility in 1,000 lbs. (Stone)

(Continued from page 228)

		No. of Analyses	Water in 1000 lbs.	Ash in 1000 lbs.	Nitrogen in 1000 lbs.	Phosphoric Acid in 1000 lbs.	Potash in 1000 lbs.	Estimated Value per ton
13	Mixed Hay	393	137	64.5	9.9	4.1	13.2	$4.33
14	Hungarian Hay	.....	77	61.8	7.2	3.5	13.0	3.50
15	Red Clover Hay	178	170	62.1	10.8	5.5	18.7	5.20
16	Alfalfa Hay	117	153	80.2	17.6	6.1	17.9	7.08
17	Corn Fodder with Ears	.....	92	37.4	4.0	2.9	14.0	2.64
18	Corn Stover	.....	150	45.3	2.7	3.8	16.4	2.57
19	Pea Vine Straw	53	136	66.0	6.8	3.5	10.2	3.14
20	Wheat Straw	80	136	53.0	.64	2.2	6.3	.94
21	Oat Straw	55	145	57.0	1.9	2.8	17.7	2.38
22	Indian Corn	149	130	14.8	12.6	5.7	3.7	4.34
23	Wheat	1358	134	17.1	16.3	8.7	5.5	5.84
24	Rye	257	134	19.8	15.8	8.6	5.8	5.72
25	Barley	1128	143	24.8	13.9	7.9	4.8	5.04
26	Oats	560	133	31.0	14.7	6.9	4.8	5.16
27	Buckwheat	20	141	27.7	12.3	6.9	3.0	4.34
28	Peas	118	140	28.1	26.8	8.4	10.1	9.16
29	Corn-cob Meal	.....	90	.....	7.0	5.7	4.7	2.90
30	Wheat Bran	93	132	58.0	19.5	26.9	15.2	9.24
31	Wheat Middlings	24	126	27.0	20.4	13.5	7.4	7.60
32	Dark Feeding Flour	.....	98	12.2	21.6	5.7	5.4	7.04
33	Rye Bran	230	125	46.0	18.4	22.8	14.0	8.46
34	Buckwheat Bran	5	156	28.0	11.8	4.2	12.7	4.82
35	Buckwheat Mid. (coarse)	6	120	47.0	35.2	12.3	11.4	11.98
36	Malt Sprouts	128	120	75.1	29.7	17.4	19.9	11.68
37	Brewer's Grains (wet)	158	762	12.4	6.2	4.2	5	2.16
38	Brewer's Grains (dry)	168	95	47.2	25.1	16.1	2.0	8.70
39	Gluten Meal	.....	86	7.3	41.2	3.3	.5	11.18
40	Hominy Feed	.....	89	22.1	12.0	9.8	4.9	4.68
41	Linseed Meal (old process)	.....	89	61.0	46.8	16.6	13.7	15.83
42	Linseed Meal (new process)	20	110	62.1	45.1	17.4	13.4	15.40
43	Cotton-seed Meal	142	88	70.5	59.5	30.4	15.8	20.82
44	Cabbage	7	856	14.1	2.8	2.2	5.2	1.48
45	Sugar Beet Leaves	8	880	23.9	2.7	1.5	6.2	1.25
46	Sugar Beet Pulp	16	898	5.8	.96	.2	.4	.32
47	Beet Molasses	35	207	106	14.5	.5	56.3	9.16
48	Apple Pomace	5	740	8.2	1.7	.1	.3	.26
49	Skim-milk (gravity)	96	904	7	4.9	2.1	2.0	1.74
50	Skim-milk (centrifugal)	7	906	7.4	4.6	2.1	2.0	1.65
51	Bean Straw	6	53	69.	11.4	2.1	18.4	5.04
52	Turnips	.....	905	8.	1.8	1.	3.9	.94

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